WORLD SWORDFISH FISHERIES

Volume IV

Latin America

Part B. Caribbean

Section 1. Anguilla to the British Virgin Islands

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WORLD SWORDFISH FISHERIES

An Analysis of Swordfish Fisheries, Market Trends, and Trade Patterns
Past-Present-Future

Volume IV.
Latin America

Part B. Caribbean

Section 1. Anguilla to the British Virgn Islands

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The Office of Science and Technology

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PREFACE

A. Latin American fisheries

The waters off Latin America, especially South America, are major world fishing grounds. The largest fisheries are conducted along the Pacific coast. Fishermen there conduct operations both to produce fishmeal and edible products. Two countries (Chile and Peru) routinely report some of the world's largest fishery catches. The Peruvian catch has approached as much as 13 million tons. This massive catch is composed largely of small pelagic species (anchovy, jack mackerel, and sardines) which are mostly reduced to relatively low-value fishmeal although smaller quantities are canned. The fisheries along the Atlantic coast are much more limited, although both Brazil and Argentina report catches at or near the 1 million ton level. While much smaller than Pacific-coast fisheries, the Atlantic catches are virtually all edible species with a higher value than the fish used for fishmeal reduction.

Latin American fisheries for edible species until the 1970s were primarily artisanal operations employing traditional methods and in many cases operating at near subsistence levels or producing non-export grade product sold for minimal prices on local markets. Several Latin American countries have made great progress in modernizing their fishing industries. The development of modern commercial and improved artisanal fisheries in Latin America has many economic and commercial implications. The industry provides many opportunities for U.S. manufacturers and other businessmen. The information in these reports may be of interest to U.S. firms attempting to assess market opportunities in the region. Fisheries in Latin America used to be an economic backwater in much of region. That has changed over the past two decades. The fishing industry in many countries in the region is creating well-paying jobs, producing food, and increasing export earnings. Available fishing fleet and catch data graphically show that Latin American fishermen have significantly expanded the fishing industry.

This synopsis of Latin American fisheries is a summary of the preface in the earlier parts of volume IV (Latin America) of the *World Swordfish Fisheries*. Readers may want to consult these books for a more expanded discussion of regional fishery developments.

B. Caribbean fisheries

The fishing industries on the Caribbean islands are generally only minor economic activities, a fraction of the size of the massive industries now conducted in some South American countries. On most Caribbean islands the local fishing industry is a relatively limited artisanal or small-scale commercial activity. This is in primarily due to the generally low productivity of tropical waters. The only Caribbean country to develop a large-scale commercial fishery has been Cuba, which in the 1960s and 70s launched substantial distant-water longline and trawl fisheries. These fisheries, however, were largely inefficient operations sustained by Soviet oil subsidies and the low crew salaries. Once the Soviet subsidies ended, Cuban distant-water operations had to be largely ended. Cuba does currently report a modest distant-water trawl operation. More profitable small-scale commercial operations have emerged on several Caribbean islands, including longline fisheries on Barbados, Grenada, St. Vincent, and Trinidad.

The fisheries on most Caribbean islands continue to be largely artisanal. While generally small they often play an important local role in providing employment opportunities and producing high protein food for the local population. On a few islands (the Bahamas, Cuba, Grenada, and Trinidad), fishery exports are of some importance. Fisheries is one of the principal renewable natural resources on many islands. These factors gives the industry some prominence on several islands, most of which have to import substantial quantities of food.

Caribbean artisanal fisheries have changed greatly in recent years and fishing effort has grown substantially. Rising educational levels and Government development programs have had substantial results. Great effort has been given throughout the region in improving vessels, adding outboard motors, and introducing more effective gear. The motorization of the fleet and the adoption of monofilament driftnets have been two especially important developments in expanding fishing effort. Another factor has been economic difficulties that have forced many individuals to enter fisheries because of the lack of alternative employment opportunities. The result on many islands has been a massive increase in fishing pressure, especially on the limited inshore demersal resources available from small island shelfs.

Fisheries on many Caribbean islands are still largely unregulated. Open access fisheries are still prevalent throughout the region. The result of the rising fishing pressure has been the depletion of inshore resources and plummeting yields. This has been the case throughout

the region on islands as diverse as Anguilla, Aruba, Hispaniola (Dominican Republic/Haiti), Jamaica, Curaçao, Martinique, Puerto Rico, and Trinidad. Cuba may be an exception as the country's political system makes it easier to control economic activity. Yet even in Cuba enforcement problems have been noted as well as environmental degradation impairing once important fisheries like the shrimp fishery. As a result, Caribbean Governments have begun changing their policies from promoting fisheries expansion to one of regulating fishing operations to better utilize the limited available resource. Some islands have begun to introduce more aggressive management systems to deal with the growing problem. While still skeptical of regulatory constraints, an increasing number of Caribbean fishermen have come to see the need for such management systems. Some examples are new or planned regulatory systems in Barbados, Bermuda, Jamaica, and Puerto Rico. Cuba has also introduced important changes in its state-owned fishing industry.

One of the policies pursued on many islands is to encourage fishermen to shift from heavily fished inshore demersal fisheries to still not fully utilized offshore pelagic fisheries. In many cases the fishermen have conducted troll fisheries using relatively small boats. Fishermen on several islands used a range of boats, including some large boats, to target the abundant flying fish resource. Fishermen on a smaller number of islands have launched longline fisheries for large highly-migratory pelagics. Some of the most important such countries are Barbados, Cuba, Grenada, and Trinidad, but St. Lucia and St. Vincent have smaller more artisanal operations. Smaller or preliminary operations have been noted on several additional islands (Anguilla, Antigua, Bermuda, the British Virgin Islands, and the Netherlands Antilles). Several important islands (the Bahamas, the Dominican Republic, Haiti, Jamaica, and Puerto Rico) still have virtually no significant longline fisheries. Among the countries that do target large pelagics, only a few have fishermen who target swordfish (Barbados, Cuba, and Trinidad), although the authors note increasing swordfish catches on Grenada.

Fisheries management in the Caribbean involves many special problems. One of the most difficult is the division of the wider-Caribbean into over 30 national Exclusive Economic Zones (EEZs). The sea area of the Caribbean is smaller than the EEZs of individual countries like Brazil, Chile, and the United States. These countries have found fisheries management to be a difficult undertaking. For many Caribbean countries, with their minuscule EEZs, limited statistical programs, small scientific communities, limited administrative resources, pressing economic problems, and minimal enforcement capabilities, fisheries management has proven to be a daunting undertaking. Effective Caribbean management regimes require a high level of cooperation among neighboring islands. This cooperation is complicated by the cultural, developmental, economic, linguistic, and political differences which separate the islands. The Organization of Eastern Caribbean States (OECS) and Caribbean Community (CARICOM) have promoted cooperation, but the continuing limitations on expanding cooperative approaches still remains a major impediment.

The Caribbean has a modest, but growing environmental movement. Until recently environmental groups on most islands were the concern of poorly financed enthusiasts with little real political influence. Governments were generally interested in economic development and often gave little real consideration to the environmental consequences. Two important developments are affecting the environmental movement. First, a new better educated generation, more aware of environmental issues, is coming into prominence. Second, the important tourist industry is becoming increasingly aware of the fact that environmental degradation is impairing the once pristine environment that has attracted tourists to the Caribbean and is the region's primary natural resource. Uncontrolled fisheries, for example, are affecting populations of species like turtles and billfish with attract divers and sports fishermen. The growth of the environmental movement has been complicated on several islands (Dominica, Grenada, St. Lucia, and St. Vincent) by Japanese fisheries assistance programs that seek to influence local governments in international environmental fora like the International Whaling Commission and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Thus there are many inconsistent policies. On St. Vincent, for example, whale watching is a popular tourist activity, but local fishermen are still permitted to hunt whales and other marine mammals. Grenada and other islands are attempting to promote the tourist industry and sport fishing is an attraction of some importance, however, longline fishermen take large quantities of billfish which are sold in local markets for modest prices.

Recreational fisheries is a subject of some concern on many islands. The potential economic importance of recreational fisheries is often not fully recognized by Government officials and even fishery managers who are often more committed to traditional capture fisheries. The Bahamas has virtually banned longlining to protect billfish and other sports species, but is the only Caribbean country to do so. On many Caribbean

islands billfish are targeted by local artisanal fishermen and widely available in markets.

C. Swordfish fisheries

The major swordfish fisheries are conducted by a small group of countries. The two most important targeted fisheries are those conducted by the United States and Spain. Several other countries like Australia Canada, Italy, Portugal, and others conduct smaller fisheries. The largest quantities of swordfish are landed by the Asian longlining operations (Japan, Korea, and Taiwan), although these countries target tuna and land swordfish only as a bycatch. These fisheries are described in detail in the NMFS *World Swordfish Fisheries* (Volumes I., II., III., V., and VI.) published in 1997.

The authors have sought to describe swordfish fisheries in Latin America as part of volume IV. of NMFS' *World Swordfish Fisheries* series.

South America--Pacific (Volume IV--Part A1): NMFS in 1997 published a description of the swordfish fisheries along the Pacific coast of South America. The principal country here was Chile. The early Chilean fishery was in effect the regions first large-scale commercial fishery. The first Latin American swordfish fisheries (Chile in the 1930s) and Peru (in the 1940s) were large-scale harpoon fisheries and at the time the most significant fishery operations in the region. These fisheries for a few years dominated the local fishing industry. Since the 1950s, the species off Latin America was fished almost exclusively by foreign fishermen conducting longline operations on the high seas and to a lesser extent through a variety of access arrangements in coastal waters. Chile has since developed a substantial driftnet and longline fishery for swordfish. Smaller longline operations exist for swordfish and tuna in Ecuador and Peru.

South America--Atlantic (Volume IV--Part A2): NMFS in 1999 published a description of the swordfish fisheries of the Atlantic-coast countries of South America. The most important country along the Atlantic coast is Brazil which developed a multiple-species longline fishery based first on Japanese and then U.S. fishing methods. A smaller fishery more focused on swordfish has developed in Uruguay. Montevideo and become a major transhipping point for foreign fleets operating in the South Atlantic. The Venezuelan fishery is largely conducted in the Caribbean.

Central America and Mexico: The authors have collected information on the swordfish fisheries in Central and America and Mexico, but have been unable to publish the results. The most important country is Mexico which has conducted a driftnet fishery most off Baja California in the Pacific. Those fishermen have begun to convert to longline operations. Some Mexican longline operations are conducted in the Caribbean, but primarily for tuna. Longline operations have also been reported by Costa Rica, but exclusively in the Pacific.

Caribbean (Volume IV--Part B): The authors in Part B of volume IV describe the fisheries of 18 Caribbean jurisdictions, some of which like the Bahamas and Netherlands Antilles are composed of multiple islands. The reports assess the fisheries on Anguilla through Puerto Rico. Plans to publish the five additional draft reports prepared on St. Lucia through the U.S. Virgin Islands and a Caribbean overview has not proven possible due to our publishing deadline. The Caribbean part of volume IV addresses the Caribbean island fisheries. The large Venezuelan fishery is discussed in the South American part of the report. We have included Bermuda in the Caribbean part for organizational simplicity, despite the fact that Bermuda is located north of the Caribbean in the mid-Atlantic.

D. Importance of the Caribbean

Caribbean fishermen with the exception of Cuba, which primarily operated longliners outside the Caribbean, have not reported large swordfish catches. Even so, a consideration of the Caribbean is an important contribution to the NMFS *World Swordfish Fisheries* series. Despite the relatively low quantities actually caught, the Caribbean is important for a variety of reasons:

Bycatch trends: Longline fishing is a relatively "clean" fishing gear in comparison to many other gears like trawls and gillnets. There is, however, a significant incidental catch associated with longline fisheries. In some fisheries the incidental catch is an important part of the economic earnings. In other instances it is unwanted species which reduce returns. The authors have addressed both elements of the bycatch which includes species which affect important NMFS management issues. The NMFS Observer Program has provided some indication of Caribbean bycatch levels, however, none of the Caribbean islands have such observer programs to provide data on bycatch levels. Thus the assessment of basic fisheries data from each island provides the only available information on potential bycatch trends. In this regard, both longline and artisanal fisheries in the Caribbean appear to be affecting species like billfish, sharks, and turtles. There is little evidence at this time, however, that in the Caribbean there are adverse fishery impacts on marine mammals and seabirds.

Cuban case study: Cuba provides an interesting case study and the authors have given considerable effort to acquiring information on this fishery--despite the considerable difficulties involved. Cuba is the only Caribbean country that has published a series of

research studies on both artisanal and commercial fisheries for large pelagics, including swordfish. The Cuban research on the artisanal fishery south of Florida is of special interest to NMFS researchers. The Cuban distant-water research in the Atlantic is of some interest to fishery biologists involved in the ICCAT research effort. The Cubans employed the same gear and methods with the same vessels for nearly 30 years, giving their data a unique character and utility to researchers. Other countries varied gear, methods, target species, fishing strategy, grounds, and other factors presenting difficulties for researchers in analyzing the results. The Cuban state-owned fishing fleet also presents an interesting case study on the effectiveness and limitations of a state fishing operation.

Flag-of-convenience registrations: The longline fleets of Caribbean countries are relatively modest. Several Caribbean countries, however, register foreign-owned fishing vessels. The most important such countries are the Central American nations of Honduras and Panama. Belize also makes some flag-of-convenience (foc) registrations. Several Caribbean islands make such registrations. The most important foc or open-registry country in the Caribbean is currently St. Vincent. Other islands register small numbers of vessels. In some cases, the international complications involved have caused these islands to rethink this policy. Bermuda is a major flag-of convenience country, but has decided not to register foreign-owned fishing vessels. The Caymans has also decided to end its registration of foreign-owned fishing boats. The Netherlands Antilles still registers a few foreign-owned fishing vessels, but it has become a contentious issue in government circles. Such policies are of some interest because of the difficulties flag-of-convenience registrations create for international management programs.

International management: It is important for the success of the ICCAT international management program for all the fishing countries participate in the program. The only Caribbean islands that currently belong to ICCAT are Barbados and Trinidad. In many cases, little was known about the status of longline and other fisheries on several Caribbean islands. The quantity of swordfish currently being taken is relatively small, but not inconsequential. Longline fisheries are expanding and new fisheries on several island are being launched. While swordfish catches are still limited, billfish and shark catches appear more substantial. These reports provide detailed information about the status of longline and artisanal fisheries on each island.

Priority species: The range of a variety of species which are of special concern to NMFS includes the wider-Caribbean. Many of these are highly migratory species whose range includes the EEZs of both Caribbean islands and the United States. These species include billfish, sharks, swordfish, marine mammals, sea turtles, and seabirds. Some of these species are affected by interactions with longline and other fishing gear. Several are actual target species. Currently there are wide differences in national legislation and management programs concerning these species. Efforts to better manage or in some cases protect these species will require a high level of international cooperation.

Research cooperation: International cooperation is essential to fully understand the natural history and behavior of highly migratory species throughout their range. With the exception of Cuba and to a lesser extent Venezuela, Caribbean researchers have devoted little attention to swordfish and related species. Foreign researchers, however, will find information on the research establishment and program on each island useful in planning their efforts in the Caribbean which could benefit from cooperation with local researchers.

Spawning/nursery area: While Caribbean swordfish catches have been limited, the wider-Caribbean plays an important role in the life cycle of this species. Some of the most important spawning and nursery areas for north Atlantic swordfish appear to be located in the wider-Caribbean. Many of these areas fall within the Exclusive Economic Zones (EEZs) of Caribbean countries. This must be taken into account in any successful international management effort.

Transhipping activity: While Caribbean fishermen themselves report modest swordfish catches, very substantial quantities of swordfish are being transshipped through Caribbean ports. Several ports have been used for such transhipments, but the two most important are Port-of-Spain on Trinidad and Philipsburg on St. Maarten. The quantities of swordfish involved are far greater than the quantities actually taken by Caribbean fishermen. Even larger quantities of tuna and billfish are involved. While the host islands (St. Maarten and Trinidad) currently have only small or nascent longline fisheries which do not significantly affect the ICCAT management program, government regulatory supervision of the transshipping operations could play an important role.

U.S. seasonal operations: Caribbean fishing grounds have been of special interest to NMFS managers because several U.S. longliners have operated seasonally in the wider-Caribbean during the offseason along the U.S. coast. The new management plan for swordfish and restrictive ICCAT catch limits has meant that fewer U.S. longline fishermen have decided to deploy their longliners in the Caribbean during recent years. Rising fuel prices in 2000 and early 2001 has been another factor limiting U.S. Caribbean fishing.

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British Virgin Islands: **Mike Christian** with NMFS provided a great deal of useful information. **Joyce Ferguson** with the BVI Fishing Company briefed the authors on the company's operations. **Tim Jones** provided information on recreational fisheries. **Bertrand Lettsome**, Chief Conservational and Fisheries Officer, provide many useful insights on BVI fisheries. **Steve Meyers** now with NMFS, but who earlier worked with the Caribbean Fishery Management Council, provided many helpful insights. Permanent Secretary **Lorna Smith** provided helpful information on BVI fisheries. **Alveson Vanterpool** with the BVI Fishing Company provided information on his company and BVI fisheries in general. Fisherman **Lowell Wheatley** provided information on fishing operations.

NOTES

The authors stress that this is not a scientific paper. The principal objective of the report is to provide and analyze timely statistical data for U.S. Government officials, company executives, consultants, academic institutions, and environmental groups, and others interested in Latin American fishery developments. The authors have sought to inform U.S. groups as to the full scope of opinions expressed in each country concerning the swordfish and other related fisheries. For this reason unverified press reports and personal interviews have been used extensively to supplement the available published literature. The offers have sought to provide a wide a range as possible of data and scientific research as well as prevailing opinions and the range of ideas expressed in policy debates.

A timely synthesis of available commercial, economic, and scientific information is needed to fully understand local fishing industries. The time required to prepare a thoroughly evaluated scientific paper would make the economic and commercial data in the report so dated that it would be of little value to U.S. readers, beyond marginal historical interest. Nor would a more scientific-oriented study be of great utility for many of the individuals and groups utilizing these reports. The authors have decided instead to provide "snap shots" of selected countries giving the reader data as well as available opinions and projections on this rapidly evolving fishery. Such opinions would have no place in a scientific studies, but are important in these reports which seek to provide an overview of both the fishing industry itself as well as how the fishermen and company spokesmen view the local industry.

In some cases opinions have been presented that can not be substantiated by available data or in other cases are contradicted by that data. A wide range of assessments are provided because the authors often do not have adequate data to determine who was correct. In other instances the authors have presented opinions with which they disagree to provide a full spectrum of thought from the region. U.S. businessmen and researchers working in Latin America, need to be aware of the full spectrum of views, even widely held opinions that may not be valid. Important decisions are sometimes based on perceptions rather than facts and as a result it is important to be aware of widely held opinions in key sectors of the industry. Knowledge of the discussions currently underway and diversity of opinions among officials, researchers, and businessmen in the region is important to government officials and businessmen planning to work in the region.

The authors have chosen to provide detailed notes to the individual island reports in this volume. The level of documentation is admittedly unusual for a Government or even academic paper. The authors have decided to make such elaborate citations for the following reasons: **Further research**: Each country report, even the longer chapters, is only a superficial analysis of the local fishery. The references thus provide interested researchers a detailed account of sources which may prove useful in pursuing specific subjects on their own in greater detail.
Evaluation: The authors have often been unable to obtain hard data on specific subjects and countries. In many cases such data simply does not exist. In other cases local officials are unwilling to release data. Often the authors had to rely on the opinions of local officials and industry leaders. The notes identify those sources to help the reader evaluate the specific statements.
Assessments: The authors have received many varied, and frequently conflicting, appraisals on the current situation from different local observers. In many instances, it was not possible to fully assess those appraisals. As a result, the authors have often presented a synthesis of different reports to give the reader a wide range of available assessments.
Unpublished: Much of the information did not come from published sources, but rather from telephone conversations and personal interviews, sometimes in Spanish. As one of the authors is not a native Spanish speakers, this creates the possibility for some misunderstanding. Dealing with the French spoken on Guadeloupe, Haiti, and Martinique provided an even greater challenge as did the Dutch on the various Dutch Caribbean islands. Obtaining information over the phone is difficult enough even in English, the intricacies of foreign languages compound the difficulties. The authors, as a result, felt it important to identify the individual source much more thoroughly than if more detailed published information had been available. Each of the interviewees was provided a draft of the report to ensure that their comments were correctly noted.

The reader should not take the information on vessel lists, vessel imports, vessel construction, company catch and processing activities, joint ventures, and other matters as complete lists. While the authors attempt to follow announcements in fishery journals, many such developments are only reported in local newspapers which the authors could rarely obtain.

Often such developments are not publicly reported at all. Thus the listings in this study are often incomplete and in many cases dated. While they can not be used as a complete inventory of such developments, they do provide a useful overview of the range and diversity of the activities involved, as well as a reasonably complete list of the established and major companies. The authors have not excluded specific companies, shipyards, joints ventures out of any policy decision, but rather because of the limited information available. In a few cases companies have declined to provide information or representatives asked that they not be cited.

The preparation of this report has been significantly impaired by the paucity of reliable statistical and other published information. This is due to several factors:

New fishery: The swordfish fishery is relatively new in many of the countries of the region, at least the swordfish and other fisheries for oceanic pelagics using modern monofilament line. In most cases it is conducted by individual boat owners or small companies, complicating data collection. Artisanal fishermen participate in several countries (Brazil, Chile, and Costa Rica) and throughout the Caribbean, making data collection even more difficult. Effective industry trade groups exist in only a few countries and in most cases these groups have little interest in swordfish.

Limited statistical data: The Government agencies in many countries do not publish extensive fisheries data. This is particularly true for small, relatively minor species like swordfish in most countries. The Caribbean island countries in particular have very limited data collection systems and in some cases no system at all. It is not, however, just a function of the size of the country. Brazil in particular does not publish an annual fisheries statistical report. In addition, many countries have reduced data collection services during the 1980s as part of the overall economic retrenchment.

Suspicion: Industry sources in some countries are reluctant to provide information. The authors are unsure why some government officials were so reluctant to provide information on their fisheries. This varied widely from island to island. Some officials enthusiastically cooperated and expressed a desire to exchange information. Some industry sources, for a variety of reasons, were also hesitant to cooperate. This is partially due to the concern that such data will be used by Government officials to enforce tax and exchange rate regulations and partly out of a general unwillingness to release information for public dissemination. This reluctance has been exacerbated by trade actions brought by U.S. environmental groups. Many businessmen are concerned with additional such actions in the future. Whatever the reason, their reluctance has made it difficult to obtain accurate information on the swordfish fishery in several countries.

Limited local assessment: General surveys of national swordfish fisheries are rare. Few local observers have published detailed assessments synthesizing available scientific, commercial, economic, and social data.

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WORLD SWORDFISH FISHERIES
Volume IV: Latin America
Part B. Caribbean

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PERSONAL OBSERVATIONS

"The potential for longlining in the Caribbean may be limited. Some opportunities for expanded longline operations may exist in a few countries, such as the Bahamas, Guyana, and Trinidad. The potential elsewhere, however, appears very limited. I believe that the small island countries may do best by focusing on coastal pelagics like dorado, wahoo, and mackerels rather than the more technically and capital intensive fisheries for the large offshore pelagics." -- Milton Haughton, Scientific Director, CARICOM Fisheries Unit, April 4, 2000.

"Countries in the eastern Caribbean are not taking full advantage of their potential to develop longline fisheries. An increase in longlining by these countries is inevitable. Longlining is less seasonal than many current fisheries and thus can be conducted during the current offseason." -- J. Chaiton, HIAMP, 1990

"... organizations like ICCAT are not nice friendly, scientific meetings devoted to the free exchange of information, data and ideas. Rather they are places where hard-nosed negotiators come together to try to lever out the best deal for the nations that they represent at the expense of any and all comers." -- Bermuda Ministry of the Environment, *Marine Resources and the Fishing Industry in Bermuda,* January 2000

"I don't think ICCAT should be worrying about what us little guys here in the Caribbean are doing. Rather its the big guys they should be going after. It is these foreign fishermen and their large boats that cause most of the problems down here." -- Arthur C. Potts, Director, Marine Resources & Fisheries, Tobago House of Assembly

"CARICOM has relied on member countries to follow the transhipping activity on Trinidad and St. Maarten. As far as we know, neither Trinidad or St. Maarten are violating international guidelines. Some CARICOM-member Governments, however, are concerned about the level of fishing and pressure on stocks involved in the foreign transshipping operations--to the detriment of local fisheries. These countries would like both Trinidad and Dutch officials to restrict the level of foreign operations." -- Milton Haughton, Scientific Director, CARICOM Fisheries Unit, April 6, 2000.

"The Commerce Department's National Marine Fisheries Service has made final regulations that ban the sale and import of undersized North Atlantic swordfish, in a move to save dwindling stocks of the species. The Commerce Department has followed through with a key fishery management element of President Clinton's plan for the ocean environment. As a leading importer of swordfish, the United States is also a world leader in conserving this and other highly migratory marine resources that travel beyond our waters." -- William M. Daley, Secretary of Commerce, March 16, 1999

"I think swordfish is the poster fish for overfishing. If we can get this one right, it can be a real model for what we can do with other fish." -- Vicky Spruill, Executive Director, Sea Web, Washington, DC, March, 1999

"SeaWeb's misguided boycott does nothing to help swordfish. The people ignoring international fishing limits are rogue fishermen from other nations whose fishery officials refuse to comply with international swordfish regulations. The markets for their irresponsible harvests are global and way beyond the reach of a boycott by restaurant chefs in the United States." -- Dick Gutting, Executive Vive President, National Fisheries Institute, June, 1999.

"Sea turtle stocks are declining throughout most of the Wider-Caribbean; in some areas the trends are dramatic and are likely to be irreversible during our lifetimes. There is a great need at this time to assess artisanal and commercial interactions with turtles. Otherwise all the effort we have made to protect beach nesting sites will be to no avail." -- K.L. Eckert, Widecast, August 15, 2000

"The results of our test fishing here in Anguilla show that to develop a successful longline fishery in any small island state there needs to be a HACCP approved offshore processing and storage facility. It's main purpose would be to store reasonably priced bait, store the fish hygienically, package, freeze, smoke and salt the various fish products. In order to guarantee supplies to the plant and to capture regional markets, the investor would be better off arranging the supplies of at least two longliners." -- Captain Robert Lee, Masterfisherman, Anguilla Offshore Fisheries Development Project, April 1999

"Our inshore demersal fisheries here in Anguilla have declined in recent years as they are being heavily fished. The Offshore Fisheries Development Project has demonstrated that pelagic longlining is possible and this could help to reduce pressure on our inshore resources. We are now studying how to best privatize the Project. Several fishermen have expressed an interest in longlining." -- Roland Hodge, Director of Fisheries and Marine Resources, September 30, 1999

"Our company here on Antigua used to export swordfish and tuna to the United States, but we now sell locally. Prices there now are just too low. In addition, complicated American import regulations make it difficult for small companies like ours, with only limited product, to ship profitably." -- Luis Barreto, Owner, Caribbean Seafood, May 25, 2000

"Yes, I do believe that commercial longlining is affecting billfish catches. Our catches in the Bahamas have definitely declined. It now takes on average about five trips before we boat a blue marlin." -- Tred Barta, recreational fisherman

"Longline fishing is a no, no." The Bahamian Prime Minister told protesting fishermen that message would be clear to everyone "at the end of the day. .... You have a very strong point of view about longline fishing and about conserving and preserving the resources, particularly the fishing resources and other resources of the Bahamas. I assure you that I also want to conserve resources We are of one accord, Our purpose and our objective are the same." -- Hubert Ingraham, Bahamian Prime Minister, December 2, 1993

"The news media here on the Bahamas has neglected the 'side' of the commercial fisherman in the controversial debate on longlining. There has been considerable emotion and disinformation put forward by the new media which unfortunately presented only one side of the debate. Longline fishing is a traditional method utilized all over the world. Last weekend I spoke to an intelligent man who knew nothing about longlining, but was opposed to it." -- Tennyson Wells, Bahamian Minister of Agriculture and Fisheries, October 15, 1993.

"My partner and I felt that if the Japanese could conduct successful operations out of St. Maarten and the Taiwan fishermen out of Trinidad, a Barbados-owned and operated could be successful." -- Jonathan Morgan, Fin and Fathoms, Barbados 1992

"I think it is ridiculous that dead fish should be discarded as a management measure. I understand that there may have to be limits put on the catch, but discarding dead fish is just plain, flat out wrong." -- Anthony Brathwaite, longline fisherman, September 22, 1999

"Our new fisheries management program is a step in the right direction of responsible fisheries management for Barbados. Managing highly migratory species like tuna and swordfish, however, is much more complicated and not something we can do by ourselves. We cooperate with the IATTC management programs and we are in the process of joining ICCAT. We have also begun to approve certificates of eligibility (COEs) for swordfish exports to the United States. -- Patrick McConney, Chief Fisheries Officer, September 22, 1999

"Tag and release fishing on Barbados was at first a hard sell. In a developing country, fish is money. You can't get away from the simple economics. But we have made a lot of progress in our tournaments. We have offered good prizes for the most releases. The fact that recreational fishermen are very concerned about the environment has made a big difference." -- David Marshall, Barbados Game Fish Association, September 23, 1999.

"Some additional artisanal fishermen and investors are considering entering the longline fishery here in Barbados. While several fishermen and investors did so in the late 1990s, there is now more hesitation about buying additional boats. Our longline fleet is reporting mixed results. Some fishermen are reportedly doing well while others are struggling." -- Anthony Stout, General Manager, Fish of Barbados, May 8, 2000

"The longline fishery requires considerable expertise and a substantial investment. It is not yet a major fishing method in Bermuda. Several factors discourage our fishermen from longlining. Fishing is a very traditional activity in Bermuda with fathers teaching sons. Few Bermuda are knowledgeable about longlining. Many young Bermudians see more opportunity in tourism, banking, and other sectors besides fishing. Also a relatively substantial investment is required for longlining. Those young people entering the industry are generally interested in more profitable recreational charter boats." -- Federika Forth, Business Development Manager, Bank of Bermuda, March 8, 2000.

"The Taiwan fishermen targeting albacore stopped buying licenses from us here in Bermuda in 1994. They have since redeployed for bigeye at more tropical latitudes. Anyway our fishermen have begun longlining tuna and swordfish and we are no longer as interested in licensing foreign vessels." --- Brian Luckhurst, Fisheries Officer, Bermuda Fisheries Division, January 18, 2000

"We hope to develop a legislative package that addresses the marine environment in a comprehensive manner, including the various user groups and the island's role in maintaining the levels of regional and international marine resources. Fish farming and longline are two achievable goals." -- Arthur Hodgson, Bermuda Environment Minister, February 2000

"During one trip out of Bermuda we caught 10 blue and 5 Galapagos sharks during the four sets I was out on the longliner *Ark Angel* during 2000. We saw some porpoises, but none even close to the gear, and didn't see any interactions with turtles or seabirds." -- David W. Kerstetter, Marine Advisory Services, September 8, 2000.

"We had a good experience with a Canadian longliner we chartered and were hopeful that the large Cuban longliner we chartered would prove even more productive. But it seems that no matter how much I explained that what we needed was swordfish and tuna, the Cuban captain insisted on landing large quantities of shark. There is no market for shark here on Bermuda, except for the makos. He didn't seem to understand that if you are in business you have to provide your customers what they want." -- Neil Inchcup, Seamont Fisheries, June 9, 2000

"The Government just plain allows too much fishing. It was bad enough with just local guys, but now they have allowed this huge 200 ft Cuban longliner to fish and sell locally. It even has a Cuban crew so our guys don't even get jobs." -- David DeSliva, Bermuda Sport Fishing Association, March 7, 2000

"There isn't much longlining here in Bermuda, except for the big foreign longliners offshore. Many of our young people, like my son, are not too interested in commercial fishing. Some are going into recreational fishing offering charter boat services to tourists which is more profitable than traditional fishing." -- Vallery Cabral, fisherwoman, *Scorpion III*, March 8, 2000

"Many of us have some success here in Bermuda with trolling for yellowfin tuna and wahoo. A couple guys have tried longlining, but have had little success. Maybe they didn't know what they are doing. The Government allowed this big Cuban longliner to operate in 1999, but the criticism was so intense that the contract was not renewed in 2000." -- John Barns, Spanish Point Boat Club, March 17, 2000

"There is very limited longlining here in the British Virgin Islands. A few fishermen beginning in the 1980s tried longlining, but with limited success. We have only one longliner at present which is run by a family operation. They mostly operate during the tourist season when the market for seafood here is very strong. -- Alverson Vanterpool, British Virgin Islands Fishing Company, January 31, 1996

"Here in the British Virgin Islands we are the largest fishing operation. My brother and I have three vessels of which the *Argus III* has been primarily used for longlining. We import squid from Florida and other places and target swordfish, tuna, and dorado. We sell the catch locally." Mark Soares, Neptune's Treasure, May 18, 1999

1

ANGUILLA

Anguilla has not yet developed a local longline fishery, although there is some interest in doing so. The local fishing industry is primarily an artisanal trap fishery landing reef fish and lobster. Fishermen use mostly small, open boats. Operations are conducted close to the island and existing grounds are heavily fished. Most fishing is conducted from southwestern ports. Only part of the catch is sold in Anguilla, although the proportion is increasing with the development of the island's tourist industry and improved retail outlets. Much of the Anguillian catch is sold on the nearby island of St. Martin with has a much more developed tourist industry. Anguillian officials have noted the longlining in the northeastern Caribbean and the transshipping through neighboring Caribbean Islands, especially St. Maarten. As a result, the Anguillian Government with British assistance in 1998 launched a test fishing program to assess the potential for longlining in Anguillian waters. Officials hope that longlining will help them diversify the island's fishing industry and more fully utilize available resources. The program has reported some encouraging results, including substantial swordfish catches. Anguillian fishermen and investors have expressed interest in initiating commercial longlining, a few have made commitments to enter the fishery in 2000-01. Some fishermen are considering operating a longliner while other fishermen are considering adding gear capable of laying artisanal longlines to their existing boats . This would allow them to combine longline operations with their current trap fishing and thus be a less financially risky entry into longlining. Planners now envision a modest fleet of about five small or medium sized longliners delivering fish to a processing plant to supply local, regional, and international markets.

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***Figure 1.**--Map of the Leeward Island*

I. Overview

A. General

Anguilla was colonized in 1650 by English settlers from St. Kitts. Unlike many other Caribbean islands, Anguilla has never been occupied by other European countries and has since the original colonization remained a British colony. Anguilla was formerly part of the British colony of St. Christopher-Nevis-Anguilla. Opposition to the association grew and finally Anguilla seceded unilaterally in 1967. Following the direct intervention of the United Kingdom in 1969, Anguilla became *de facto* a separate dependency. This status was formally recognized by the United Kingdom in 1980 and a new Constitution implemented in 1982 and significantly amended in 1990. A Governor is appointed by the British Crown who is responsible for external affairs, defence, internal security and the public service. The legislature is the House of Assembly.

***Photo 1**.--Anguilla is a very low-lying island with numerous white sandy beaches. Tourist development has expanded rapidly in recent years. Dennis Weidner*

Anguilla is the most northerly of the Leeward Islands, located about 110 kilometers (km) to the northwest of its former partner, St. Christopher, and 8 km to the north of the French/Dutch island St Martin/St. Maarten. The territory is also composed of Sombrero Island and several other islets and cays (including Dog Island and Upper and Lower Pickley Pear Cays).

Anguilla is one of the smaller Caribbean islands with a very limited population. The island, however, is surrounded by a large area of shallow marine banks which it shares with other neighboring islands (St. Martin/St. Maarten and St. Barthélemy).[1] Anguilla's names derives from its shape, that of an eel--"anguile" in French and anguilla in Spanish.

B. Fishing industry

The Anguillian fishing industry is largely artisanal. About 400 fishermen are involved full and part time in the fishery. They deploy about 200 boats most of which are less than 10 meters.[2] The OECS reports that Anguillian vessels range from 5-10 m in length, powered by outboard motors. Most boats are operated with a crew of 2-3 persons, depending on the type of fishery.[3]

The fishermen mostly use traps, largely traditional arrowhead shaped targeting lobster and reef fish. Most of the vessels are equipped with winches to raise the traps. Some fishermen also deploy lines. Fishermen use some vertical longlines which they call rigs and deploy for deep slope demersals. Handlines may be set along the traps or rigs. Seasonally some encircling nets may be set for coastal pelagics. A few beach seines are also used. There is also some diving.[4] Some experimental pelagic longlining has been conducted. One local fisherman experimented with a longliner even before the British Offshore Fishery Development Project (OFDP) test fishing project began in 1998.

Catches appear to have declined in recent years, reflecting the heavy effort in the island's inshore waters. Fishermen remember the much higher catch rates that were once common place. The fishermen are

Photo 2.--The Anguillian fishery is largely artisanal. These divers harvest conch which is in high demand, especially at tourist restaurants. Dennis Weidner

now operating further offshore and catching less.[5] Actual catch data is only available since 1987. The record catch of 418 metric tons (t) was reported in that year (appendix A1). The catch declined to 330 t in 1993. The catch has since increased somewhat to 360 t in 1997.

There are two principal fisheries on Anguilla, finfish and lobster.

Finfish: The major demersal species taken are grunts, groupers, parrot fish, squirrel fish, and goat fish. A few seines are deployed for bonitos and jacks. A few fishermen use lines and spears.[6] The principal Anguillian fishery for finfish is conducted from southwestern harbors. Much of the catch is marketed biweekly on nearby St. Martin. Only a small part of the finfish catch has actually been sold on Anguilla. Many fishermen have established personal relationships with hotels and restaurants on St. Martin. Fishing patterns are significantly affected by markets which operate biweekly on St. Martin.[7] (See "Markets".)

Lobster: The other major fishery on Anguilla is for lobster. This fishery is conducted from northeastern harbors, primarily Island Harbor. The fishery is highly seasonal and almost entirely devoted to supplying tourist restaurants and hotels. The spawning season is also the offseason for the tourist industry, a convenient coincidence. Lobsters are taken with traps. Spear fishing is not allowed. An increasing proportion of the lobster catch is marketed on the island as the tourist sector expands. The lobster fishermen switch to finfish after the lobster season ends. Fishing effort increased in the early 1990s as the expanding local tourist industry fueled demand. Hurricane Luis in 1995 sharply reduced pressure on the resource as a result of the damage to vessels and traps. Fishery effort has since slowly recovered.[8]

Other: There is also some diving for conch.[9,10] Octopus are also taken.

Anguillian fishermen all operate as individuals. There are no cooperatives are associations. Many only fish part time. One of their greatest problems have

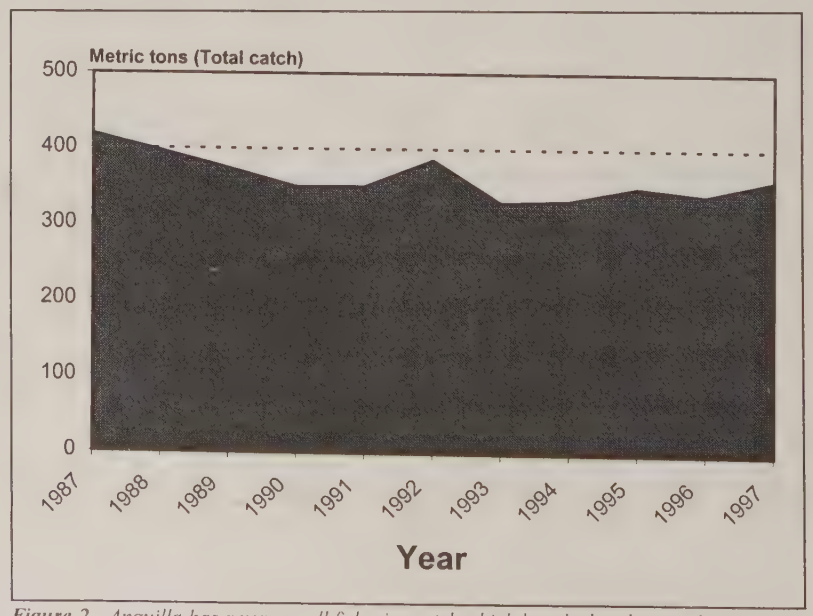

Figure 2.--Anguilla has a very small fisheries catch which has declined somewhat since the 1980s

been hurricanes which have in the past destroyed both their boats and gear--principally traps. Hurricane Luis in 1995 largely brought the island's fishing industry to a standstill, damaging boats and destroying almost all of the traps that fishermen use.

Most of the Anguillian catch is sold fresh with little or no processing. The product marketed locally is sold at the beach landing sites or directly to tourist hotels and restaurants. There is one popular modern shop offering both fishing tackle and fish. It is operated by Ed Carty. Fresh fish can be purchased filleted.

Pelagic species include king mackerel (kingfish), queen fish, dorado, barracudas, mackerels, and to a lesser extent--tunas. The small domestic market is inadequate and the fishermen depend on exports markets on neighboring islands.[11] Some of the catch is impaired by ciguatera.[12] The fishing industry and much of the island's basic infrastructure was heavily damaged by Hurricane Luis in 1995. Contrary to what might be expected, the island even though fish is exported is not self dependent in fisheries production and has to import fish to satisfy local demand.[13] This is particularly true during the tourist season.

Many of the traditional stocks targeted by the fishermen appear to be declining. Fishermen report having to fish at greater distances from the island. Operations up to 65 km from Anguilla are now common. Closer in grounds have been largely depleted.[14]

Much of the catch was exported, but this pattern is changing. One 1987 study indicated that 40 percent of the finfish and about 75 percent of the lobster was exported to neighboring islands (St. Martin, the USVI, or Puerto Rico) with larger tourist industries.[15] Exports to St. Martin have been particularly important. But this has not been formalized exports, the fishermen just cross the small distance between the two islands and sell their catch directly to St. Martin customers. The expanding tourist industry on Anguilla, however, has meant that more of the catch is now marketed on the island.[16]

II. Species

The authors know of no studies describing swordfish off Anguilla. Some limited data is available from other sources or from neighboring islands. The information being collected by the current British Offshore Fishery Development Project (OFDP) is the first serious study to focus on swordfish specifically from Anguilla. Some tagging work from foreign researchers provide basic information about the movement of swordfish in and around Anguilla and neighboring islands.

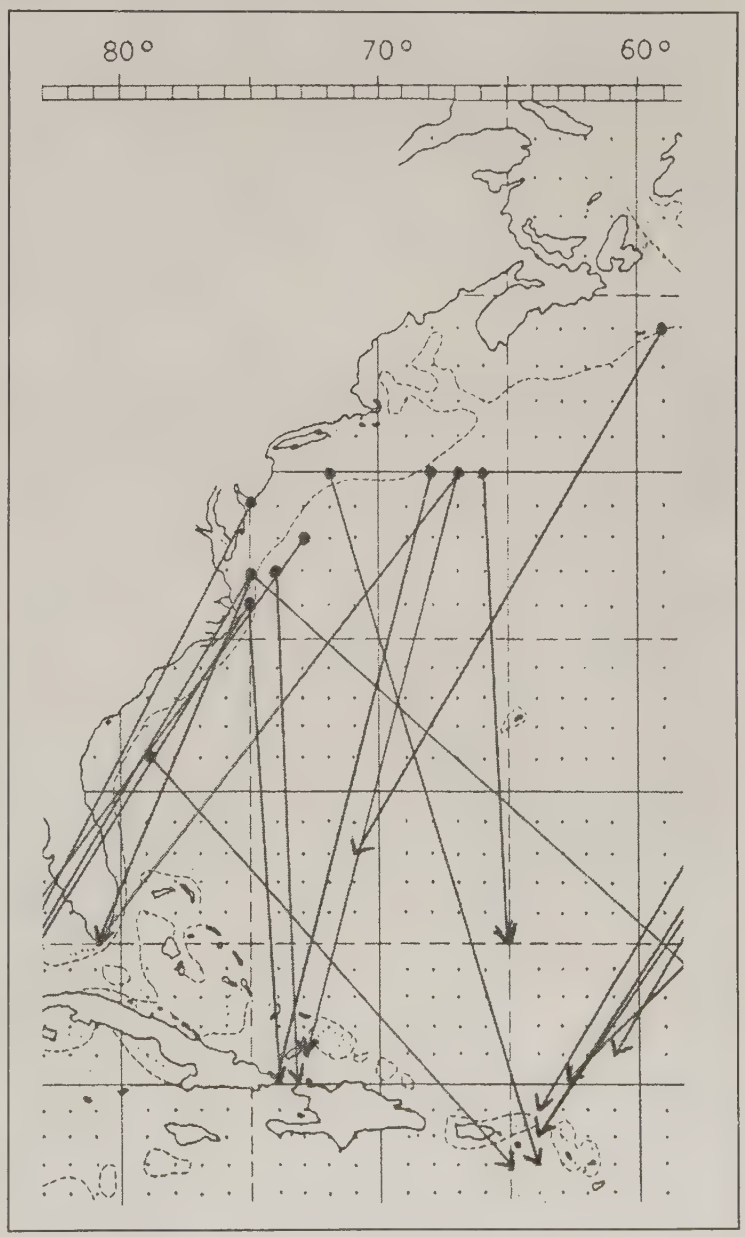

Figure 3.--Swordfish recovered around Anguilla and the Leeward Islands were tagged in rich northern feeding grounds. Two of the fish tagged off the U.S. coast were taken southwest of Anguilla.

A. Spawning

The spawning grounds for swordfish are primarily deduced by the location and abundance of swordfish larvae. One 1983 study reported that there is relatively little spawning within the Caribbean itself, although some limited spawning does take place around Cuba in the western Caribbean. There is also some spawning in the Lesser Antilles, primarily from north of Anguilla to St. Lucia. The larvae found in the Lesser Antilles are both small and large sized. The lesser numbers of small larvae suggest that spawning is less intense than in the western Caribbean off Cuba. The numbers of large larvae suggest that spawned larvae are retained there or recruited from adjacent regions.[17] Researchers have identified the Anegada Passage and northeast of the Lesser Antilles as areas where mature fish are present and spawning may be occurring.[18] A more recent analysis shows a similar pattern of larval concentrations in the Gulf of Mexico and U.S. southeastern coast, but some more limited concentrations in the northern Lesser Antilles.[19]

B. Migration

The best evidence on swordfish movements comes from tagging. Tagging swordfish, however, has proved to be a difficult proposition. One of the biggest problems is the small number of fish taken by the catch and release recreational fishery. The limited number of tag returns suggest a movement of swordfish from the Caribbean sill to and from the northwest Atlantic. Available tag returns show that several swordfish have been tagged off New England and the Grand Banks and retrieved in the northeast Caribbean (Caribbean Overview, appendix C3). Five swordfish have been tagged south and southwest of Anguilla in the Caribbean. Three were retrieved off New England and one on the Grand Banks (BVI, figure 3). Another was retrieved at about the same latitude northwest of the Cape Verde Islands (Caribbean Overview, appendix C3).[20] The fish tagged east of Anguilla in the Atlantic were also mostly retrieved off New England and the Grand Banks (BVI, figure 3). One fish, however, was retrieved off Haiti in the Windward Passage (Haiti, figure 3). While the migratory movement of swordfish are still quite speculative, the tag results and accompanying time interval data are consistent with the postulated track of swordfish following the north Atlantic Subtropical Gyre in a clockwise seasonal migration.[21] One interesting observation is that the further west the fish were tagged in the wider-Caribbean, the more likely they were to be retrieved along the U.S. coast. The further east they were tagged in the Atlantic beyond the Antillian Arc, the more likely the fish were to be retrieved east of the Grand Banks. A similar phenomenon can be observed for swordfish on southbound migrations (figures 3-4). While the number of tag returns is still quite small, the pattern is notable. The development of new archival tags will provide much more information on swordfish migratory movements in the next few years.

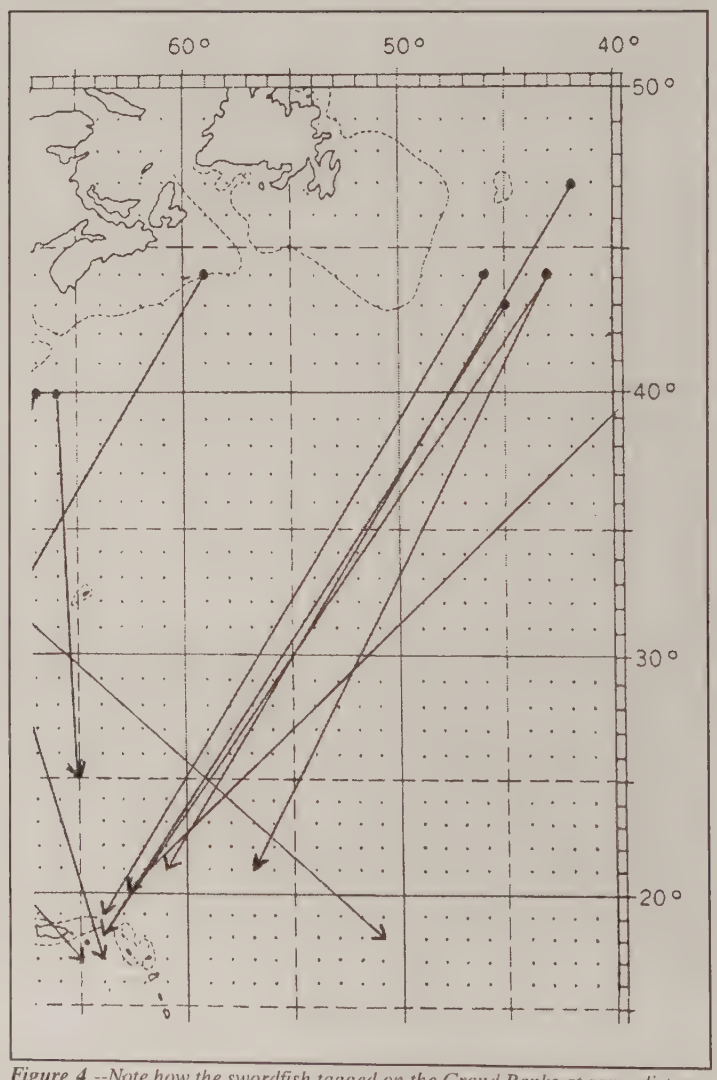

Figure 4.--Note how the swordfish tagged on the Grand Banks at some distance to the U.S. coast were mostly retrieved in the Atlantic east of Anguilla.

III. Grounds

A. Oceanography

Anguilla is situated at the extreme northeastern corner of the sill that encloses the Caribbean Sea. As a result, its 200-mile Exclusive Economic Zone (EEZ) extends fully 200-miles north and northeast out into the Atlantic. Ocean waters to the north fall off sharply into the Puerto Rico Trench with depths exceeding 7,000 meters (m). North Atlantic deep water is primarily advected into the Caribbean through the Windward Passage, but some also enters through the Anegada and Jungfern Passage.[22]

B. Topography

The narrow island of Anguilla stretches from the northeast to southwest. Anguilla is a low-lying island of coral and limestone formation. The highest elevation at Crocus Hill at only about 65 meters. Anguilla has several offshore cays and is fringed with more than 35 beaches, many of which are just beginning to be developed for tourism.

The bulk of the Anguillian EEZ lies to the north and east of the islands where the 200-mile projection is not hemmed in by neighboring islands. The waters to the north, however, are dominated by the Puerto Rico Trench which begins its spectacular decent about 60 kilometers (km) offshore. Deep water in the Trench can exceed 7,800 meters (m) and is found about 150 km north of Anguilla.

The Anegada Passage is the deepest cut in the outer Caribbean sill. Some sources report that the passage varies from about 1,950-2,300 meters. Another source suggests 1,915 m (Caribbean Overview, appendix B1). As a result, the Anegada Passage is one of the principal connections between the Atlantic and Caribbean. The Anegada Passage is located to the northwest and west of Anguilla and separates the island from the nearby British Virgin Islands (BVI), another U.K. Overseas Territory. Anguilla shares its shelf with St. Maarten/Martin and St. Barthélemy to the south which severely limit Anguillian waters along the southern coast and cut Anguilla off from any projection into the Caribbean

Photo 3.--The principal port on Anguilla is Sandy Bottom. It is the main cargo harbor as well as a landing site for the OFDP and many artisanal fisherman. Dennis Weidner

Photo 4.--The main port of Sandy Bottom can be seen in the background and the Anguillian salt ponds are in the foreground. Dennis Weidner

Sea. These neighboring islands in addition to the BVI to the west and Barbuda to the southeast limit the Anguillian EEZ.

C. Fishing grounds

1. Anguillian fishermen

The diverse waters around Anguilla including the island shelf, offshore cays (Sombrero Cay and Dog Islands to the west), the Anegada Passage, and the deepwater of the Puerto Rican Trench provide extremely varied fish habitat. Anguillian fishermen thus have access to a variety of species. Most fishermen, however, target the familiar reef fish in shallow inshore waters and around the offshore cays.[23]

a. Artisanal fleet

Anguilla's artisanal fishermen target inshore resources, setting usually home-made traps in relatively shallow waters. The artisanal fishermen are restricted by the EEZs of the neighboring islands to the south and west. Grounds are very limited along the shallow southern coast, because St. Martin is located only a few kilometers to the south, leaving a very narrow fishing area along Anguilla's southern coast. The limited range of the small boats restricts their operations to the north and east. In fact, the deepwater Puerto Rican Trench to the north of the island acts as a barrier because there are few resources that the small Anguillian boats can target in the deepwater and they do not have the range to move beyond it.

The Anguillian fishermen targeting finfish focus on the island shelf and offshore banks. Many fishermen fish to the west off Dog Island and Sombrero Cay or off Scrub Island to the east. The longest trips made by the artisanal fishermen are conducted by a few lobster fishermen who may fish up to 65 km off shore.[24] Most fishing takes place within 65 km of the north and northwest coast, 50 km of the eastern coast, and 10 km of the southern coast. Operations to the south are limited by the marine zone of nearby St. Martin. Rarely do Anguillian fishermen venture beyond 65 kilometers.[25]

b. Longline test fishing

Anguillian officials are interested in promoting a fuller utilization of available fishery resources. Officials are encouraging fishermen to target pelagic resources further offshore. Such operations would require a shift from trap fishing and small boats with limited range. Given that Anguillian fishermen are not familiar with longline operations, the Government obtained British assistance for a test fishing project to assess longline techniques.

The Offshore Fishery Development Project (OFDP), using the *Axa Fishtec,* is conducting longline test fishing in the deepwater to the north and east of the island where the artisanal fishermen rarely frequent. The *Axa Fishtec* has rarely been deployed around the islands and shallow water to the south of Anguilla in the channel between Anguilla and St. Martin. All of the OFDP operations to date have been within the island's 200-mile EEZ. While sets have been made as far as 250 kilometers (km) from the island, some have been closer in--such as the area around Sombrero Cay. Catch rates have reportedly not varied greatly between the close in and more distant sets, except during the summer. Water temperatures does affect catches and during the summer when water temperatures rise, sets were made in the cooler offshore waters.[26]

The goal of the OFDP is to assess the available fishery resources and demonstrate the effectiveness and profitability of longline operations. (See "Fleet Operations and Gear".)[27] The OFDP has not yet completed an assessment of the 200-mile EFZ, but plans to continue the assessment, if the project is extended by the British Government.[28]

2. Foreign fishermen

Only limited information is available on foreign fishing operations off Anguilla. The primary foreign fishing operations are Asian longliners transhipping from a Japanese facility at St. Maarten. The Anguillian fishermen often refer to the vessels involved as Japanese vessels, but most of the vessels calling at St. Maarten in recent years appear to be Taiwan longliners (appendix D). (See "International.") Grounds north and east of the Caribbean appear to be the principal fishing ground for the Taiwan fishermen, although patterns have varied over the years.[29] The Japanese and Taiwan longliners mostly fished in the second, and to a lesser extent, the third quarters. The Koreans also fished in the fourth quarter (appendix D).

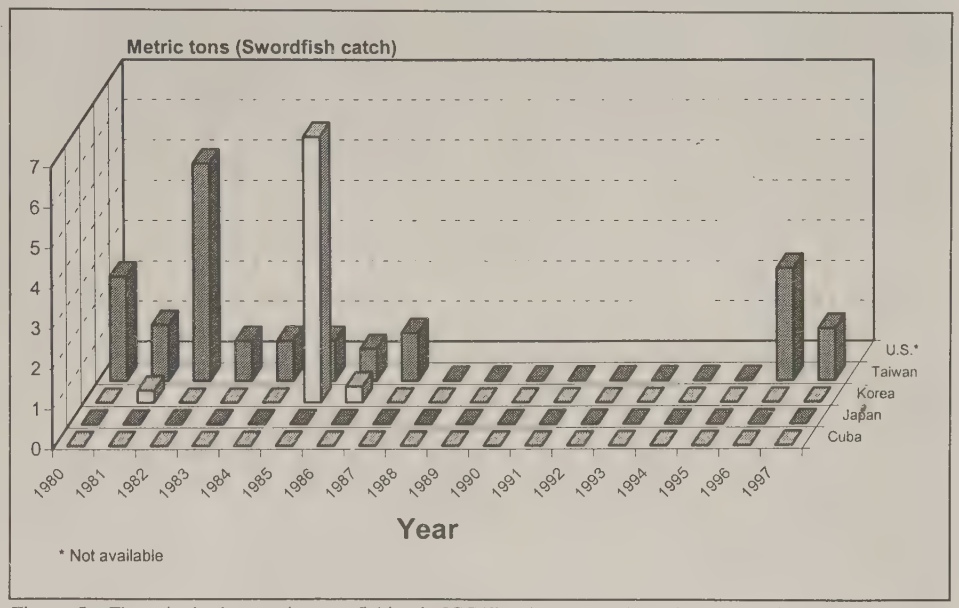

Figure 5.--The principal countries now fishing in ICCAT 5 degree quadrant 1560 are Taiwan and the United States.

The swordfish bycatch reported by these countries was generally less than 1 t, but in one quarter (2nd quarter of 1966) Japan took 8.6 tons. The only countries currently fishing in the area are Taiwan and the United States.

The limited patrol capability of Anguillian Police Marine Department means that the Anguillians do not have detailed information on Taiwan or other foreign fishing patterns. The small number of seizures, however, confirm that fishing is conducted by the Taiwan fishermen. (See "Enforcement") One enforcement officer who boarded a seized Taiwan longliners noted local grounds marked on maps. These areas included: Saba Banks, areas to the west of Sombrero Cay, areas to the east of Scrub Island, around Dog Island, and other areas.[30] Anguillian fishermen usually spotted the Asian longliners coming toward St. Maarten from the north and leaving St. Maarten moving to the north.[31] Since the seizures, however, spottings in the inshore waters where the Anguillian fishermen operate have become infrequent.

IV. Fleet

A. Artisanal

Artisanal fishermen mostly use open whaler boats, with rounded hulls. The boats according to a 1984 report averaged about 8 m in length, equipped with two outboard motors (25-30 horsepower).[32] A 1996 report indicates the artisanal vessels are now somewhat larger, mostly measuring 8.5-10.0 meters. Estimates vary on the number of vessels. One source reported about 200-250 artisanal vessels were in operation in early 1996.[33] Another estimates about 140 fishermen working on 110 boats in 1999. Including part-time fishermen there may be as many as 260 fishermen. Almost all of the vessels are now motorized--many with two outboard motors as a safety precaution.[34]

Photo 5.--Many Anguillian artisanal fisherman use small boats like these often with twin outboards for added speed. Dennis Weidner

B. Commercial

Anguilla has had no commercial fishing vessels such as longliners or trawlers.[35] There has been some limited test fishing. One Anguillian fisherman did some experimental longlining with his 11-m boat *Daisey* in the early 1990s. He looked at some of the Cuban, Taiwan, and U.S. longline operations and set a 25-km longline, including night sets. He reported taking sharks and wahoo.[36]

Anguillian fishery officials during 1995 reportedly discussed possible British financial assistance to purchase a longliner.[37] The project was approved and the country's first longliner, the *Axa Fishtec*[38] was purchased in the United States during 1998. The vessel is 17-m long and is equipped with an 6.6 t ice hold and carries a crew of five persons.[39] There are eight berths which accommodate the five-man crew and three trainees. The vessel was drydocked on St. Maarten for repairs in September 1999, but was relaunched in June 2000.[40]

Anguillian officials are now planning to privatize the OFDP project and the *Axa Fishtec*. They want a prospective Anguillian buyer to commit to building a processing plant. They reason that this would create job opportunities on the island and insure that the purchaser is serious about the project. Several Anguillian fishermen and investors are interested.[41] There appears, however, to be more interest in the boat than in building a processing plant. They hope to finalize the sale by September, 2000. While they realize that prospective buyers are more interested in the boat than building a processing plant, they are convinced a processing pant is needed. Currently hotels and restaurants buy fish in the United States. Poor inter-island connections often makes it more difficult to do business with neighboring islands than the United States. A small plant built to HACCP standards thus could potentially do quite well.[42]

Government officials think that installing longline gear on existing vessels may be an attractive option. It would allow the fishermen to combine longlining with the existing trap fishery.[43] Some fishermen have expressed an interest in this option.[44] It would appear to be a more manageable step for the artisanal fishermen interested in longlining. It would allow them to gain experience with longlining without the major investment in a dedicated

longliner.

C. Recreational

Anguilla does not have a well developed recreational fishery, Government officials report only modest activity.[45] Interest in recreational fishing, however, is increasing--in part because of the expanding tourist industry. One 1996 report indicated that only two recreational fishing boats (about 12 m) were operating out of Anguilla. A 1999 report suggests a substantial expansion of the fleet with more than 25 vessels permitted for sport fishing.

Photo 6.--Rebel Marine is Anguilla's largest shipyard. They serve the many recreational boats operating from the island. Dennis Weidner

The Anguillian sport fishing vessels are about 8-9 m long and usually carry about 3 fishermen. The boats make inshore runs allowing the tourists the opportunity to take wahoo, barracuda, and a variety of inshore species on nearby banks. The boats are mostly open boats engaged in general tourist operations, such as giving tours of the island or taking divers to spots where they can snorkel. In many cases they are artisanal fishermen who find recreational fishing is a lucrative supplement to their normal fishing operations.

Anguilla has no developed big game fishery.[46] There was in 1999 only one Anguillian boat equipped for big game fishing, the 9.5 m *Daisey* at Road Bay. The owner is one of the major figures in the local fishing industry--Ed Carty. He was the fisherman who experimented with longlining and also operates the principal retail outlet for fish on the island--The Fishery & Fishing Supplies. (See "Companies".)

Some boats from the nearby island of St. Martin also participate in the Anguillian recreational fishery. The French boats tend to be larger than the Anguillian boats--mostly about 9-14 meters. They carry 5-6 people.[47]

V. Shipyards

Boat building on Anguilla, as much of the Caribbean, has changed significantly in recent years. Local shipwrights used to lay keels for the common whalers from available wood and lay planks around them. Today most boats are built from imported plywood strengthened by plywood cross pieces. Many are covered with fiberglass laminates.

There are no large commercial shipyards on Anguilla. Several local shipwrights build boats. Three local artisans operate "marinas," which construct the whalers used by the artisanal fishermen.

Rebel Marine: The largest Anguillian vessel is Rebel Marine at Rockfield which builds many of the boats used by local fishermen.[48] Rebel Marine is a fairly large operation by Caribbean standards, working on both recreational and fishing boats. They both build and service boats, working on boats of up to about 15 meters. They were working on about 10 boats during September 1999, mostly recreational boats. They had an order to build recreational boats for a North Carolina company. There boats at Rebel Marine are constructed from plywood with fiberglass laminate.[49]

Others: The other shipwrights are smaller, backyard operations.

The typical artisanal boat is an open 7-8 m hand made whaler. The artisanal fishermen themselves often maintain their own boats but may turn to a local shipwright to deal with serious problems. They rely on Anguilla Techni Sales to service their outboard motors.

Photo 7.--Rebel Marine has received orders from North Carolina yards to build small recreational vessels. Dennis Weidner there

Photo 8.--The Rebel Marine boats are now mostly a plywood-fiberglass construction. Dennis Weidner

None of the Anguillian yards are capable of handling a commercial longliner. Longliners would have to go to neighboring islands for repairs. The OFDP, for example, turned to a shipyard on St. Martin in 1999 to service the *Axa Fishtec*.[50]

VI. Fleet Operations and Gear

A. Artisanal

The island's artisanal fishery has become increasingly sophisticated in recent years. There are about 120 artisanal, full-time fishermen.[51] As many as 260 fish at least part time.[52] There is no cooperative or fishing association, they operate as individuals.

The fishermen use small boats in inshore waters or the offshore cays. (See "Grounds".) Groups of about 3 fishermen operate their whaler boats mostly in trap fisheries. The fishermen deploy about 30 traps which they haul 2-3 times a week.[53] The most common traps are the Antillian fish drop and arrowhead designs. Most fishermen make and maintain their traps themselves. The fishermen have hydraulic winches.[54] Fishermen also deploy other gear including hook and lines, bottom lines, and seines--including beach seines. There is also some diving.

The principal fisheries taken are parrotfish, hinds, bonitos, jacks, and lobsters.[55] Operations are largely confined to inshore waters, although a few fishermen targeting lobsters go out as far as 65 kilometers.[56] A small quantity of pelagic species are also taken by the artisanal fishermen, primarily dorado (dolphinfish), barracuda, and king mackerel (kingfish).

Many fishermen have grown up in fishing. Often their fathers were fishermen and have learned the trade as children. Many of the methods and gear have changed little. The major change has been with the boat propulsion. A generation earlier oars and sails were still used, perhaps with small outboards. Currently most boats have good sized outboards and many boats have large double outboards.[57]

B. Commercial

There are no known commercial operations by private fishermen, but a test fishing project is just ending in 2000. At least one local fisherman has bought a longliner and others are doing so.

2. Test fishing

The Anguillian Fisheries and Marine Resources Department (AFMRD), however, began test fishing operations with the new longliner *Axa Fishtec* in 1998. Fishing trips are normally 4-5 days which after the project was underway averaged about 4 sets (appendix D8).[58] The vessel deploys a 40-km monofilament 1,000 lb test mainline which can be set with nearly 800 hooks, although 600 is more common. The hooks are generally set at depths from 35-65 meters. Monofilament is also used for the secondary lines and leaders. Four beeper buoys are attached to the line at equal-distant intervals. The hooks lines are spaced at about 50-60 m (figure 8).[59] The hooks are generally set at depths of 35-65 meters.[60] Two different gear arrangements are being used with varying float arrangements. The most commonly used arrangement is 7 hooks between the buoys. This would result in a distance of about 350-400 m between floats. Sometimes five hooks are used between floats resulting

Photo 9.--The Anguillian Offshore Fisheries Development project has used the Axa Fishtec for test fishing. The vessel is now for sale to local fisherman Dennis Weidner

Photo 10.--The OFDP has used its small, cold store at Sandy Bottom primarily to store bait. Dennis Weidner.

in 250-300 m between buoys. The vessel has gear that permit sets with 9 m and 18 m droplines. Various combinations are used to determine the depth at which fishing is best and then the line set to depths at which the most strikes are achieved. Combinations commonly used are two 9 m drops followed by two 18 m drops. Sometimes only one 9 m and 18 m drops are set.[61] The results average about 0.3 kg per hook for each set.[62]

The AFMRD uses water temperature, seabirds, presence of bait fish, seaweed, and past fishing experiences in deciding where to set the lines. The project has averaged about 5 sets per month. This would have been higher, but at the beginning of the project for the first 4 months, the vessel was used for overnight trips with just 1 set because ice was not available for longer trips.[63] There has from May 1998 through April 1999 been 65 sets. The crew varies from 4-5 persons. Operations to date have been limited to about 250 km from the island, some fishing is conducted as close as 50 kilometers.[64] In a few cases there have even been sets as close as Sombrero Cay. Catch rates have been similar with sets close to the island and further offshore--except during the summer when water temperatures rise. Then sets have to be further off the island or in deeper water to get good results.[65]

The AFMRD has stayed within Anguillian waters for the test fishing to fully assess the resources available in Anguilla's EEZ. The AFMRD has primarily focused on grounds to the north and east. To the south Anguillian waters are limited by the coastal zones of St. Martin (France) and the Virgin Islands (U.K. and U.S.) The Offshore Fisheries Development Project (OFDP) has focused on an area north of Anguilla (18°15' by 20° N and 62°40' by 63°20' W). This is the farthest the vessel has been deployed from the island.[66]

The OFDP has not decided what species to target in the longline fishery. Initial operations have landed substantial quantities of swordfish. About 50 percent of the landed fish is swordfish (appendix C). The catch has been primarily swordfish, tuna (albacore, bigeye, and yellowfin), billfish (white marlin and sailfish), sharks (mostly blue, mako, and tiger), and oilfish. The marlin catch is highly seasonal. No wahoo are reported. About half of the catch has been swordfish averaging about 30 kg (dressed weight) which would mean fish about 43 kg live weight. The largest swordfish taken was a 145 kg fish. Only about 2-3 sharks per set are retained because there is a very limited market for shark on the island. Most of the large sharks are discarded and the few retained are generally the smaller ones. All the oil fish are discarded. The trips are generally short, usually only 1 or 2 days in duration. The catch is landed in Road Bay.[67]

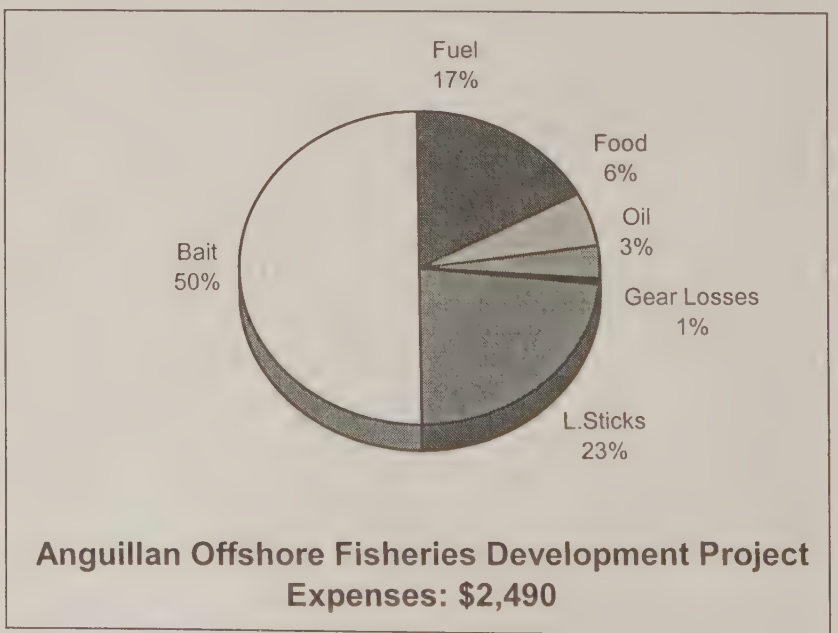

Figure 6.--The single most important expense for OFDP longline operations is bait, which amounts to half of total operating expenses. The expenses for a trip total about $2,500.

When targeting swordfish, the fishermen set the line at sunset and allow it to drift until sunrise. Lightsticks are affixed on the hook lines. After the line has drifted for 6-7 hours, it is then retrieved or hauled in (appendix B1). The procedures for tunas is quite different. The line is set just before sunrise and allowed to drift for 6-7 hours before hauling it in. Hauling usually continued into the night.[68]

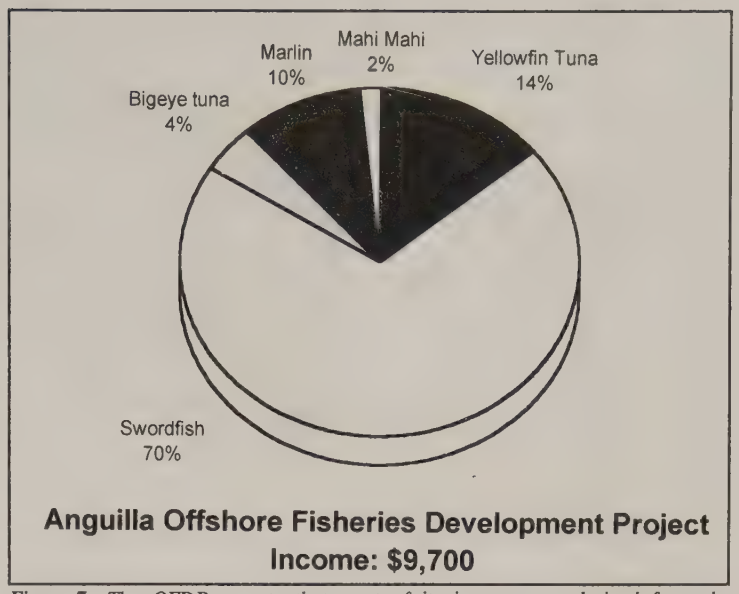

Figure 7.--The OFDP reports that most of its income was derived from the swordfish catch. Tuna and marlin were also of some importance. Income totaled nearly $10,000 per trip.

Lightsticks are mainly used with the swordfish sets. Green light sticks are generally placed on every other hook. The masterfishermen prefers the green sticks. They were placed about 2 m above the hook. It is not clear whether the light attracts the bait fish and thus indirectly attracts the swordfish or whether the light directly attracts the swordfish. It could be a combination. However they work, the light sticks clearly increase the swordfish catches. Swordfish use their bills or swords to strike prey. As some of the fish are ensnared in the line, it appears that they are striking at the lightsticks, this draws the hook up and ensnares them. The wounds to the body of the trunk, however, reduce the value of the catch.[69]

The OFDP primarily used squid as bait. As squid was not available locally, it had to be imported making it quite expensive. The OFDP recommends that local bait if it can be obtained cheaper should be investigated. The disadvantages are that it must be washed, graded, and packaged into convenient forms and then blast frozen to maintain the necessary texture when it is thawed and used in fishing operations. The OFDP recommends bait to be cut into pieces about 0.7-0.8 kilograms.[70]

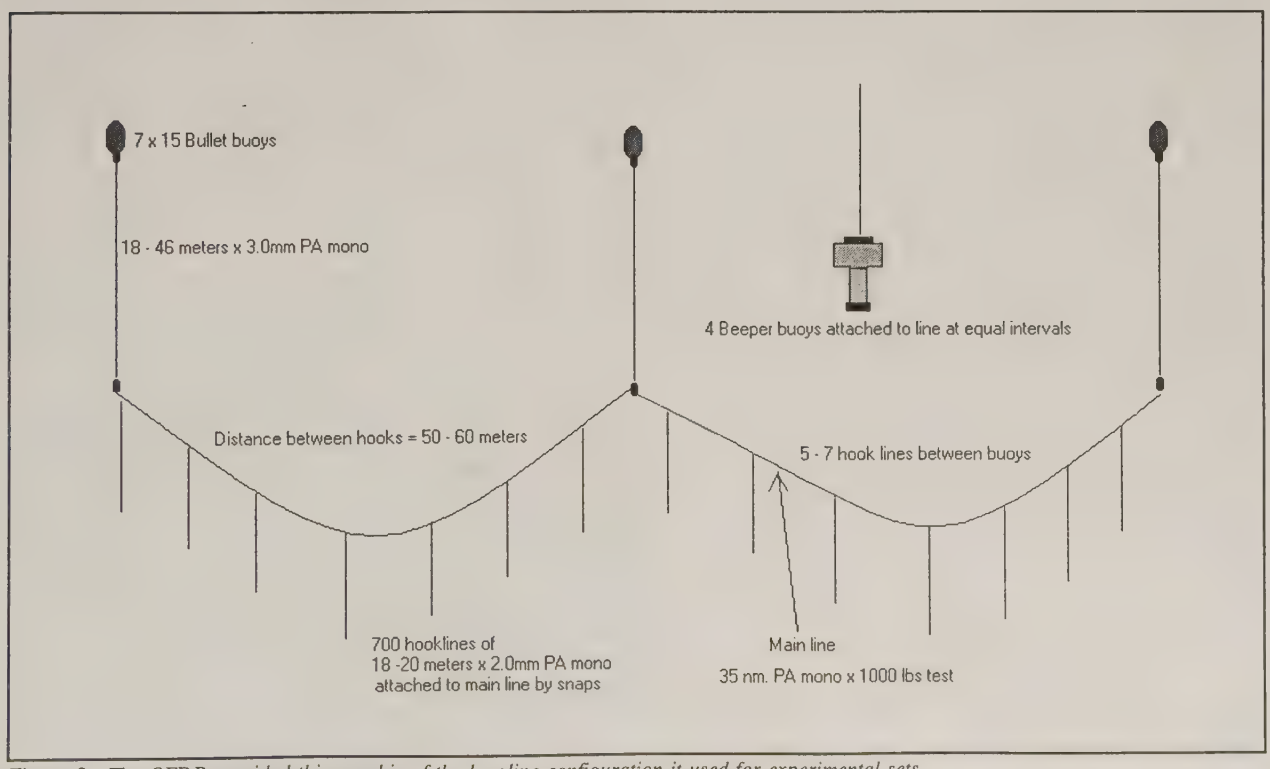

Figure 8.--The OFDP provided this graphic of the longline configuration it used for experimental sets.

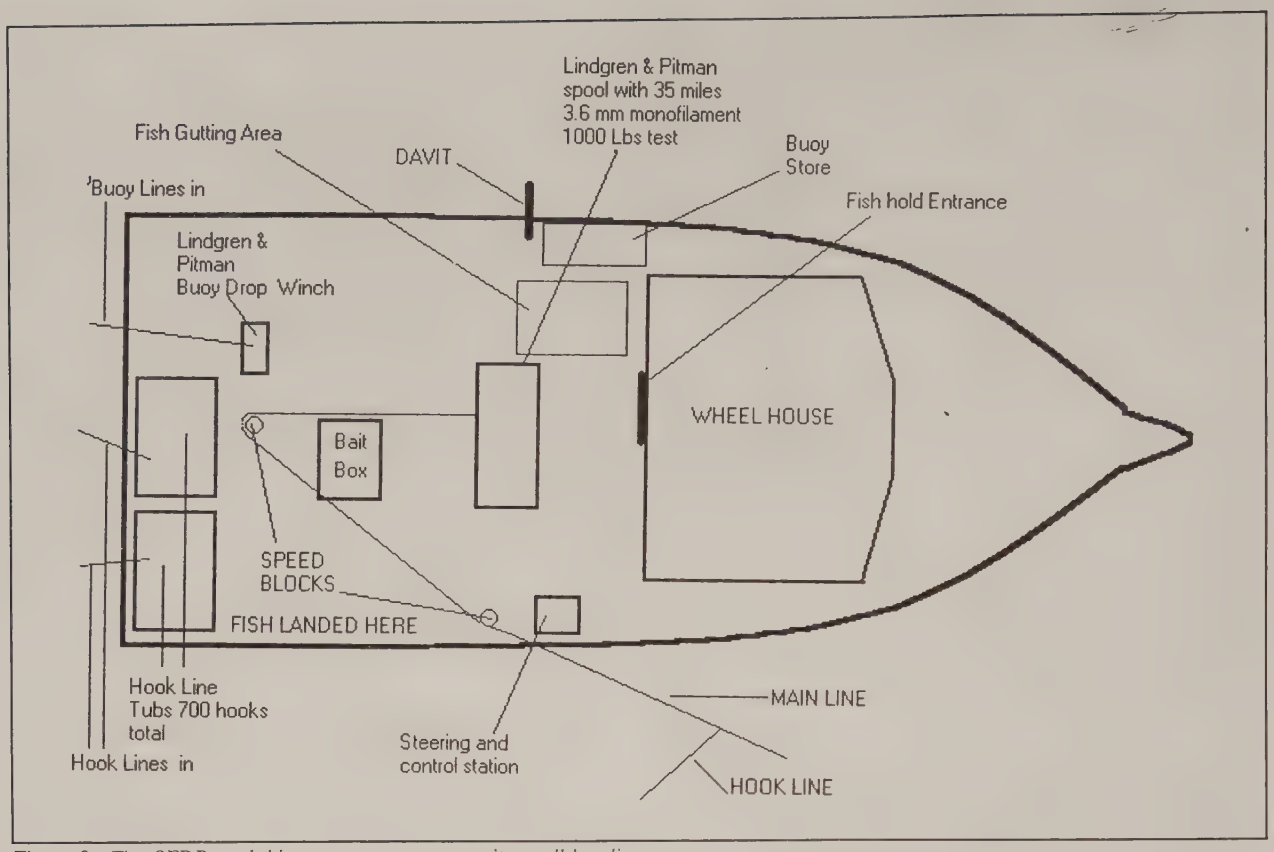

Figure 9.--The OFDP used this gear arrangement on its small longliner.

The OFDP found that moon phases influenced fishing results. From the first quarter to the full moon catches improved with the fish feeding deeper and deeper. On the full moon, catches dropped off and then begin to increase toward the last quarter with the fish feeding at increasingly shallow depths. During the phase of the new moon, catches drop until the coming of the first quarter again.[71]

Anguillian officials report that the OFDP test fishing has demonstrated the economic viability of longlining in Anguilla. Operations will generally be short trips which the fishermen prefer. Likely commercial operations would be 5-day trips with about 4 sets. Officials report that the test fishing conducted suggest a return on capital of about 19 percent (appendix B7).[72] OFDP officials have prepared detailed instructions for prospective investors and kept detailed logs on operations (appendices B4-8). The logs provide data on the locations of sets, times, winds, direction, hooks, and bait and will prove helpful to fishermen entering the longline fishery.

2. Vessel purchases and rigging

Several Anguillian fishermen are planning to enter the longline fishery in 2000. An Anguillian fisherman in 2000 purchased a 12-m longliner which he is rigging with a 16 km longline. He plans to be ready for the 2000-2001 fishing season. Another fisherman in 2000 is rigging his 10-m open boat with a 6.5 km longline that can be expanded to about 10 kilometers. Still another fisherman is rigging his 13-m boat with a 25-km line to target wahoo, mahi-mahi, and tunas. The most significant longline operation, however, will be the fisherman or investor who by September 2000 buys the *Axa-Fishtec* which has been used by the OFDP.[73]

C. Recreational

Recreational fishermen in Anguilla target mostly wahoo and marlin.[74] As there are only a few dedicated recreational charter boats, one sport fisherman suggests a good option is to hire an artisanal fishermen for the day. Typical catches include wahoo, dorado, grouper, snapper, mackerels, and perhaps a few small marlins, both white and blue.[75] Spear fishing is reserved for the islands artisanal fishermen and tourists are not allowed to spear fish.[76] The best fishing occurs between March and July.

VII. Catch

Anguilla has a very small fishing industry. Catches in the 1990s have varied from 330-390 tons (appendix A). The 1997 catch was 360 tons. The catch is composed of a wide variety of finfish, but two of the most valuable species are spiny lobster and conch. Much of the catch is a variety of demersal reef fish including a wide variety of snappers, grunts, hinds, goatfish, angelfish, parrotfish, and many other species. Pelagics are taken seasonally in smaller quantities and include jacks, dorado ("dolphinfish"), barracuda, and king mackerel ("kingfish"). Except for the OFDP test fishing, there has been no known swordfish catch. FAO in 1997 reported that the Anguillian catch consisted of finfish (240 t), lobster (100 t), and conch (20 t).[77]

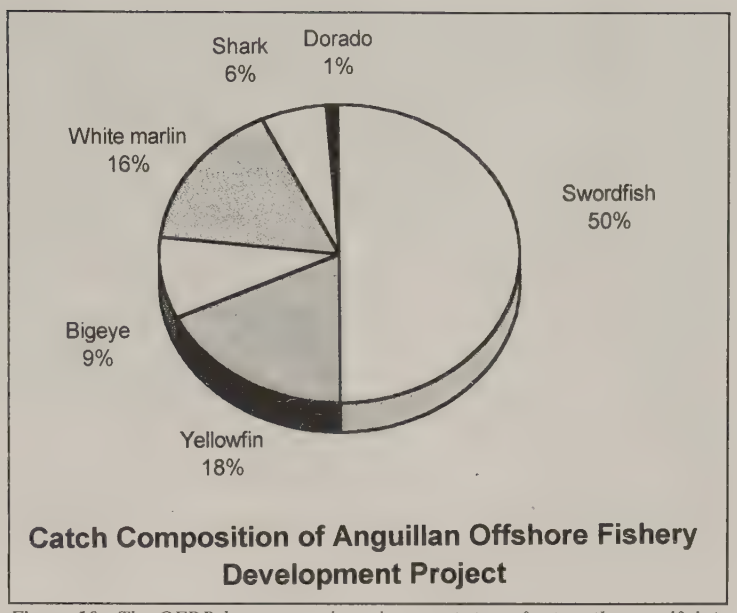

Figure 10.--The OFDP has reported catches consisting of primarily swordfish in quantitative terms, but with important catches of tuna and marlin.

***Photo 11.**--This catch from the Axa Fishtec shows catch of mostly swordfish and tuna. Dennis Weidner*

The OFDP has focused its efforts primarily on swordfish. The OFDP during its 1998-99 test fishing work reported a total catch of about 17.9 tons. About 50 percent of the catch was swordfish (appendix C).[78] Which would mean that the swordfish catch totaled 9 tons. Based on the OFDP data, this would mean about 6 t of swordfish was taken in 1998 and 3 t in 1999 (appendix A2). The rest of the catch reported was tuna (yellowfin and bigeye) and white marlin with smaller quantities of shark and dorado (appendix C). The OFDP primarily targeted swordfish in evening with light sticks which is why the catch was predominately swordfish, but some sets were also made in the morning for tunas (appendix B1). Only about 6 percent of the catch was sharks, presumably because of the night sets. Very little dorado and wahoo were reported.[79]

Available reports suggest that several Anguillian fishermen will initiate longline operations in 2000-2001. Combine with operations of the *Axa Fishtec*, annual swordfish catches will probably exceed 10 t by 2001 and if the new operations prove successful could be substantially more in 2002.

VIII. Ports

Fishermen land their catch at various sites along the many bays with ring the Anguillian coast. The finfish fishery is mostly conducted from southwestern ports while the lobster fishermen work from northeastern ports.

West End: The largest fishing village is West End and a substantial part of the islands catch is landed there.[80] The developing tourist hotels are concentrated at West End.

Photo 13.--A few concrete piers have been built in recent years at several locations for the artisanal fisherman. Dennis Weidner

Road Bay/Sandy Ground: The main commercial pier is located at Sandy Ground, also referred to as Road Bay. (The port is generally referred to as Road Bay, while the village around the port is usually referred to as Sandy Ground.) The Marine Department of the Anguillian Police have a pier at Sandy Ground. The new longliner *Axa Fishtech* is based at Road Bay. The catch is landed at the police pier or, if it is particularly large, at the commercial pier. Facilities at Sandy Ground include an ice plant with a 1.4 t capacity (24 hours), a small 1.1 t cold store (used mostly for bait), and an area (72 square meters) for storing fishing gear.[81] Artisanal fishermen also land substantial quantities.

Island Harbour: The main fishing fleet is located at Island Harbour from where several hand-made 7-8 m open boats operate.[82] A 20-m concrete pier is located there. The lobster boats are concentrated here.

Cove Bay: Another important landing site is Cove Bay. A new 20-m cement pier has been built there.

Fishermen land a substantial part of their catch at Marigot on the nearby island of St. Martin. Informal arrangements between authorities on the two islands allow Anguillian fishermen to sell in the local market and to make deliveries to restaurants and hotels with which they have sales agreements. The French/Dutch island has a much larger tourist industry. As a result, prices have tended to be better on St. Martin than Anguilla.[83]

Photo 12.--Sandy Bottom is used by cargo vessels and the few Anguillian commercial fishing vessels. Dennis Weidner

IX. Transshipments

There are no swordfish or other fishery transshipments through Anguilla.[84]

X. Processing and Products

All of the Anguilla catch is landed fresh and has to be sold immediately or kept on ice for a day or two. Anguilla has only one small cold store located at Sandy Ground, but it is used mostly for bait. Some but not all of the artisanal fishermen use ice to keep their catch fresh. The artisanal fishermen do not process their catch, but sell it whole directly to hotels or restaurants, to retailers, and at beach or roadside marketing points--mostly unprocessed. Fishing and Fishing Supplies opened a retail fish store in 1989 and does some processing. This has, as a result, substantially increased local demand.[85]

The Offshore Fishery Project also lands fresh fish which is kept in ice holds. The swordfish trunks are sold whole to two local concerns who then butcher them for retail sales. Much of it sold to tourist hotels, but local consumers are also beginning to purchase it as it is often available in fillets or other butchered form at Ashley The Fishing and Fishing Supplies retail outlets.[86]

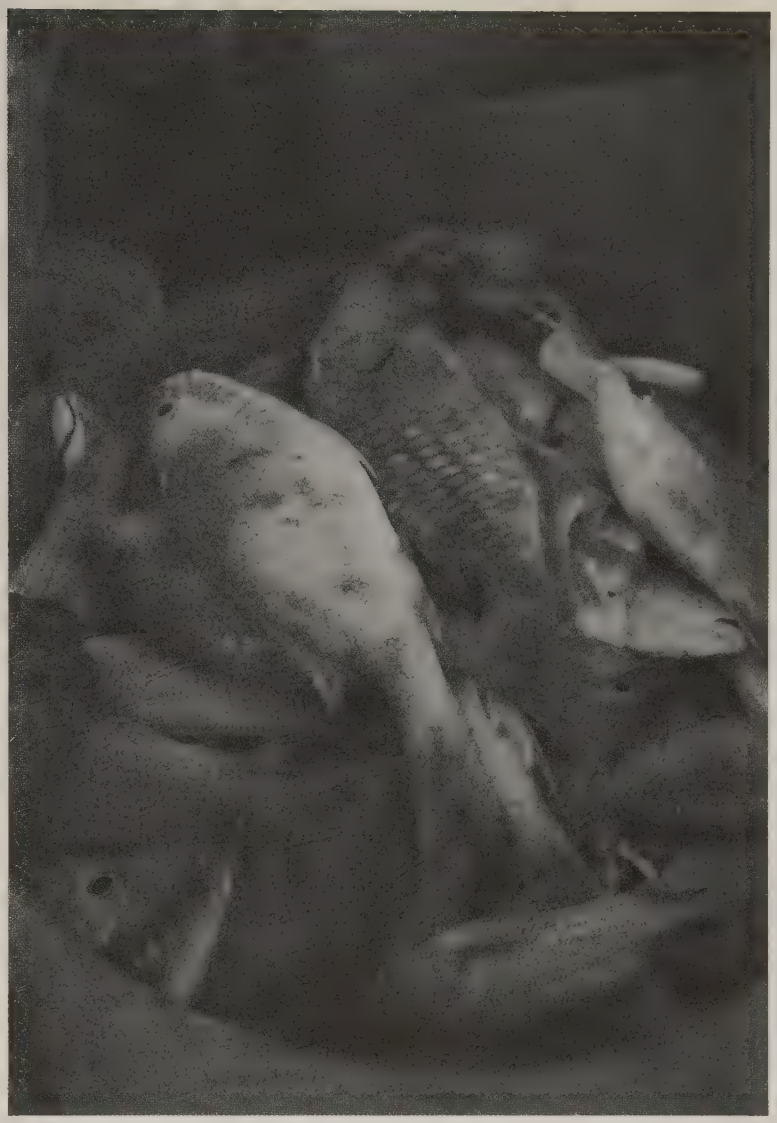

Photo 14.--These snappers, parrot fish, and a variety of other species are taken in the Anguillian pot fishery. Dennis Weidner

XI. Companies

There are few Anguillian seafood companies. Many fishermen market their own catch. There are a few small fish shops.[87] There are no cooperatives.

Ashley and Sons: This company is Anguilla's largest supermarket. They have a fresh fish counter which offers swordfish, tuna, and other species taken by the OFDP. Ashley does not process the fish, but simply butchers pieces of the trunk on demand.

Fisheries and Fishing Supplies: The largest Anguillian fishing company is Fisheries and Fishing Supplies which both markets seafood (mostly butterfish, hinds, parrotfish, and snappers) and sells fishing equipment to the local fishermen. They process fish delivered by the OFDP, including swordfish. Swordfish trunks are used to produce fillets. Both fresh and frozen fillets were regularly available in 1999 because of the successful test fishing. The company has become an important domestic outlet for the fishermen to the extent that traffic becomes heavy around the store in the afternoon when customers drop by after work to buy fish for the evening meal. The company's owner used his 11-m boat *Daisey* to do some experimental longlining in the early 1990s.[88]

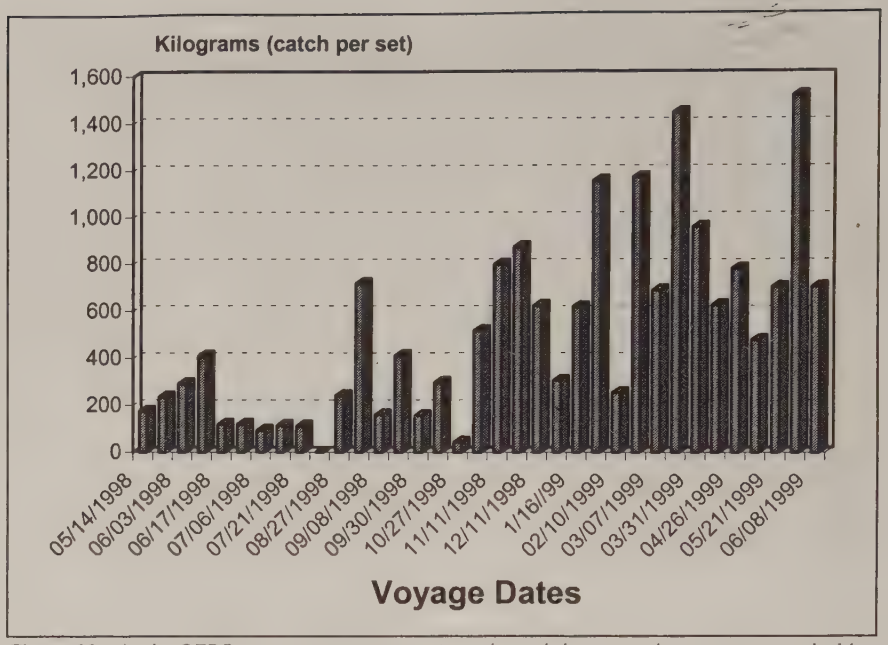

Figure 11.--As the OFDP crew grew more experienced, much better catches were reported. Most of the catch, including swordfish, was delivered to Fishing and Fishing Supplies for processing.

XII. Markets

A. Domestic

Anguilla because of its size has only a small domestic market. Anguillian fishermen land some of their small catch for subsistence. Small quantities are also sold domestically. The lack of a strong domestic market has been a major impediment to fisheries development on Anguilla.[89] Until recently the resource was not being fully utilized, in part because of the lack of a sizeable domestic market. Traditionally the fish were sold on the beach

Photo 15.--The most important retail fish market on Anguilla is the Fish and Fisheries Supplies. They also sell gear to the fisherman. Dennis Weidner

Photo 16.--Many Anguillian fisherman use very similar boats. Much of the catch is sold on nearby St. Martin--which can be seen in the background. Dennis Weidner

or at road-side stands.

Seafood marketing patterns have changed on Anguilla in recent years. While traditional marketing patterns persist, fish marketing on Anguilla changed substantially during the 1990s. There is now a strong and growing demand for seafood on Anguilla. Improved retail markets have been introduced, including one fish monger and a supermarket with a fresh fish department. This has made good quality fresh fish more easily accessible. The growth of the tourist industry on Anguilla has also provided many new local outlets for the fishermen.[90] The improved availability of high-quality seafood appears to have stimulated domestic demand.

The most important market for Anguillian fishermen has traditionally been nearby St. Martin which has a much larger tourist industry and population than Anguilla.[91] The tourists on both Anguilla and St. Martin associate bountiful seafood with an island like Anguilla and expect to eat seafood on their vacations. They often demand, however, species not normally taken by the local fishermen. The OFDP is providing species like swordfish and tuna that Anguillian fishermen were not previously able to supply. Even so, species like shrimp which American tourist particularly request, cannot be supplied locally. The tourist demand, because it is so strongly associated with the tourist industry on both Anguilla and St. Martin, is highly seasonal. Biweekly markets operate on St. Martin which has a major impact on fishing patterns on Anguilla. Many Anguillian fishermen plan fishing trips on Tuesday and Friday. The fish is kept on ice and then sold in St. Martin on the following Wednesday and Saturday. These sales are facilitated by an informal arrangement between French and Anguillian authorities. The Anguillian fishermen pay a set fee for the use of a market stall and to moor their boat. Anguillian officials in turn permit the French fishermen from St. Martin access to Anguillian waters.[92] Some Anguillian fishermen have sales arrangements with the local tourist hotels and restaurants for their catch of luxury species (primarily red snapper and lobster). Such arrangements are not limited to Wednesday and Saturday like the market sales. There also are a few fish shops, small

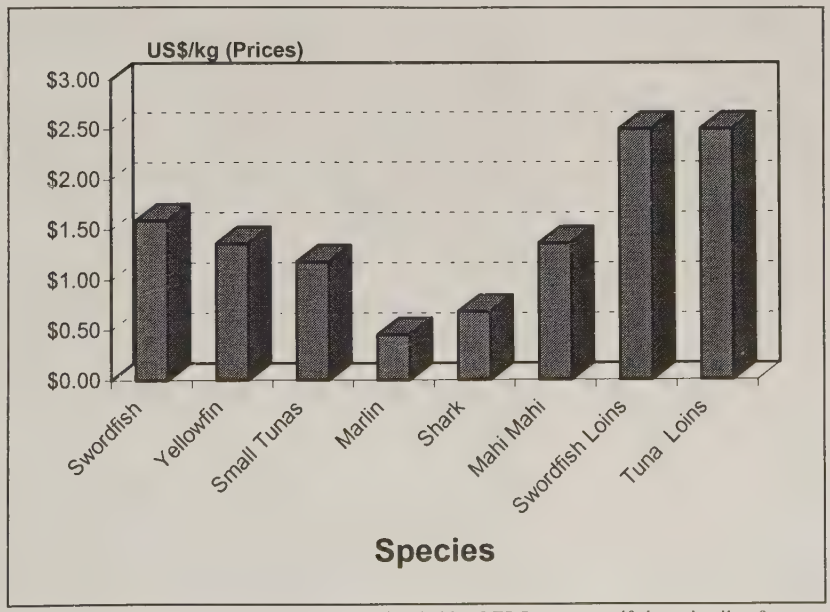

Figure 12.--The two most valuable species landed by OFDP are swordfish and yellowfin tuna

retail/wholesale outlets where the fishermen can sell their catch. These shops act as intermediaries between fishermen and restaurants, hotels, and individuals.[93]

Anguillian officials believe there is a need to better organize domestic marketing. Domestic demand tends to be highly seasonal, mostly from September to January.[94] Since the expansion of the Anguillian tourist industry, however, demand patterns are being increasingly affected by the tourist season.

The entire catch of the Offshore Fisheries Development Project is marketed domestically on the island. The AFMRD distributes the catch to a supermarket (Ashley and Sons) and one retailer (Fishery and Fishing Supplies). The Project has trouble selling the shark catch which limits the numbers retained.[95] Swordfish was virtually unknown on the local market until AFMRD began marketing the catch in 1998. One local fish retailer reports that the species have since become quite popular in his store.[96]

B. Trade

The Anguillian trade of seafood products is difficult to assess. A substantial part of the catch has traditionally been sold on nearby St. Martin. While this is an export, it is done informally and thus no data exist to determine the extent of this trade.

1. Exports

Anguillian fishermen have traditionally complained of weak domestic demand and poor prices. As a result, a substantial part of this catch is exported. Although domestic consumption is increasing in importance, export sales are still very important. Unlike many Caribbean countries, exports to the United States are very limited, only 0.3 t of groundfish in 1996 and 0.1 t of flatfish in 1998. There are in fact very limited formal exports.

Many fishermen simply land and sell their catch on St. Martin without the formalities of exporting it.[97] While this is an export, it takes place without all the formalities associated with exporting. It also means that no statistical data is available to Anguillian officials. The lobster catch is mostly exported, primarily to St. Martin. Much of the fish catch is also marketed on St. Martin.[98] St. Martin is only a few kilometers from Anguilla and a convenient location for the fishermen to sell their catch. Not only is their a substantial tourist industry on St. Martin, but the French population on the island appreciates the reef fish (especially hinds, butterfish, and parrotfish) taken by the Anguillian fishermen.[99] Unconfirmed reports suggest that small quantities of seafood are also air shipped to neighboring islands, especially St. Thomas (USVI).

Anguilla, as its fishermen have not traditionally caught swordfish, has not exported the species (appendix E). The swordfish, tunas, and other species being taken by the AFMRD test fishing aboard the *Axa Fishtec* is also being marketed locally.

2. Imports

Anguilla imports substantial quantities of fish in per capita terms. Imports have increased as the tourist industry on Anguillian has grown. Shipments total about $0.5 million annually, a sizeable sum for a small entity like Anguilla. Most of the imports are frozen product which supply the demand of the tourist industry, both in quantity as well as the diversity of species required by the tourists.[100]

Relatively small quantities of swordfish are involved. The tourist hotels have imported small quantities of swordfish, primarily from St. Martin.

***Photo 17.**--This fisherman has brought back a catch of conch which is harvested by diving. Dennis Weidner.*

Most of the swordfish originates in Miami. Anguillian sources report that in early 1999 they were working with two Miami companies, MC Fresh (Mitsubishi) and Luber who supply both fresh and frozen processed product. The fish is either shipped directly to Anguilla if it is a big load or through St. Martin for smaller shipments.[101] Interestingly, American tourists having a seafood meal have no idea that the swordfish was actually imported from the United States and not locally caught fish. Some fish actually was caught in Caribbean waters, shipped to Miami for processing, and the processed product shipped back to Anguilla and other Caribbean islands.

Some billfish is also involved in this trade, but not through the United States. The authors are unsure about the source, but fish landed by the Taiwan longliners on St. Maarten is the most likely source. The Nichirei company on St. Maarten does separate the Taiwan billfish landings from other species for marketing in the Caribbean.[102] The authors have no data as to where in the Caribbean this billfish is being sold. There is no reason to believe that Anguilla is not one of those islands. The Taiwan operation in Port of Spain, Trinidad markets bycatch in the southern Lesser Antilles.[103] The Taiwan-caught billfish does not seem to be commonly available in retail outlets, but appears to available in hotels and tourist restaurants.[104]

XIII. Government Policy

The agency responsible for fisheries is the Anguillian Fisheries and Marine Resources Department (AFMRD) in the Ministry of Home Affairs, Natural Resources, and Tourism.

A. Fisheries law

The principal Anguillian fisheries law is the Fisheries Protection Ordinance of 1982. The regulations implementing the Ordinance were issued in 1988. The AFMRD is currently updating the regulations because of the changes in the fishery during the 1990s and the initiation of the Offshore Fishery Development Project. The Ordinance only covers artisanal and recreational fishing. Thus the initiation of commercial fishing requires substantial additions to the regulatory framework.[105] British advisors have provided a variety of recommendations to Anguillian officials, especially the need to reflect commitments to international conventions. Anguilla itself is not a signatory to some of the international conventions and treaties. Anguilla does sign some of the regional agreements like OECS and CARICOM. Where Anguilla is not a signatory, the United Kingdom represents Anguilla as it does for its other Overseas Territories. In older documents, the term (Dependent Territories was used.) Commitments made by the U.K. then have to be reflected in Anguillian regulations.[106]

B. Permits

The Fisheries Protection Ordinance provides two types of licenses:

Commercial: The law refers to commercial licenses which are in fact for the artisanal fishermen. The term "commercial" refers to the right of the fishermen to market commercially and not to the size of the vessels or the sophistication of operations. The AFMRD has been refusing many new requests for additional commercial licenses because existing grounds are already heavily fished. Only Anguillian nationals qualify for the commercial licenses. The actual license fee is very low, US$4-35 (EC$10-100).[107]

Recreational: Recreational fishermen pay an application and license fee of US$200 (EC$500) annually. The license does not specify which species can be taken, but the catch can not be landed and sold commercially. It can be consumed on board or landed as a trophy.[108]

Anguillian officials are not favorably disposed toward foreign fishing. Taiwan fishermen when they used to pass close to the island had been known to lift the traps of the local fishermen.[109] British observers report that the activities of foreign fishermen, including damaging gear and lifting traps set by the local fishermen, have confirmed the widely held opinion that access granted to foreign fishermen will adversely affect domestic catch rates. Officials recognize, however, that they have only a limited capacity of enforcing Anguilla's 200-mile EEZ.

The Government has thus adopted a policy of allowing foreign fishermen to fish north of 19°N.[110] This is an area beyond the range of most Anguillian artisanal fishermen. While Anguilla does permit foreign fishing, no licenses were issued in 1999.[111] Anguilla is an associate member of OECS. One 1993 report indicated that the Government was moving toward adopting the OECS licensing scheme. The 1988 Fisheries Protection Regulations are based on regional harmonized legislation.[112] Officials in 1999 were studying the possibility of granting fishing

licenses to foreign vessels if they would land their catch in Anguilla. This would make the construction of a processing plant on the island more feasible. Such licenses would be issued until Anguillian fishermen acquired their own longliners.[113]

C. Limits

The United Kingdom declared a 3-mile Territorial Sea for dependencies in 1878.[114] That Act covers all dependent territories not covered by subsequent specific territory claims. The U.K. subsequently declared a 200-mile Exclusive Fishery Zone (EFZ) for Anguilla in 1981.[115] The EFZ covered about 85,500 square kilometers. When the U.K. signed the LOS Treaty the EFZ effectively became an EEZ.

The Anguillian 200-mile EEZ projects a full 200 miles to the north and northeast into the Atlantic Ocean. The EEZ is much more limited to the west (Virgin Islands) and south and southeast (St. Martin and Antigua). The British Government negotiated a marine boundary agreement with the United States (for the U.S. Virgin Island) in 1993.[116] The resulting boundary may be the shortest marine boundary yet negotiated between two countries. The British, however, have not defined the boundary between the British Virgin Islands and Anguilla. As both are British territories, apparently the need to define the boundary has not been pressing. The subject has, however, risen among the fishermen in the two territories.[117]

D. Management

The Offshore Fisheries Development Project (OFDP) in collaboration with the AFMRD and OECS have drafted a fisheries management plan for Anguilla. The working team drafting the plan determined that more systematic data collection was needed for effective management. The OFDP is cooperating with the AFMRD to develop more effective strategies for collecting data and disseminating information. The OFDP has also recommended that a participatory relationship needs to be established between the AFMRD and the local fishermen.[118]

Fishery officials are concerned about the declining yields in the artisanal fishery. Fishermen

Photo 18.--Anguilla's Department of Fisheries nd Marine Research is located on Crocus Hill. It has promoted the OFDP to help local fisherman begin longlining. Dennis Weidner

report taking a week to catch what once could be caught in a day.[119] Other fishermen report having to fish at increasing distances.[120] Officials have not yet decided on how to address the problem, but have conducted in house discussions. A variety of approaches have been considered, including limited entry. The AFMRD is already refusing to approve some licensing applications, but on an *ad hoc* basis. The AFMRD has not yet closed the fishery. The most likely management regime will be limitations on effort, but no definitive decision has been made. There are some existing limitations on fishing effort, such as minimum sizes of lobster and conch and trap mesh size. Under consideration is limitations on the number of traps. Such limitations are of course unpopular with fishermen, but the fishermen are increasingly realizing that measures are needed to prevent further declines in stocks.[121]

E. Promotion

The AFMRD provides a variety of services to the island's fishermen, such as purchasing wire in bulk to resell to the fishermen for trap construction. The Government is trying to encourage the fishermen to target lightly utilized pelagic resources. The Government is administering the Anguillian Offshore Fishery Development Project (OFDP), funded by the British Ministry of Overseas Development Assistance. The 2-year Project was initiated in May 1998 with a $1.1 million budget.[122] Government officials had recommend the trap fishermen troll to and from their traps, but the fishermen believe that such operations are too time consuming.[123]

Government officials are seeking to diversify the fishery and reduce pressure on heavily fished coastal demersal stocks. Anguilla has very limited natural resources. The small island has no significant mineral resources, other than a few salt ponds. The terrain is mostly rock with sparse scrub. The relatively low precipitation rate limits agricultural production. Officials thus are interested in the fishing industry, despite its small size, because fishery stocks are the most important natural resource. Thus the full and sustainable utilization of available marine resources is of considerable interest to officials.[124]

One possible alternative resource is offshore pelagics which local fishermen have not targeted.[125] Given the more sophisticated technology and greater investment required for oceanic pelagics, local artisanal fishermen needed Government support to enter the fishery. The Government as an alternative began working to obtain British assistance to purchase a longliner in 1995.[126] The British finally approved the OFDP in 1998, allowing the AFMRD to purchase a longliner in the United States, the *Axa Fishtec*.[127] The Offshore Project primarily focuses on swordfish and tuna.[128] Project managers have trained 12 local fishermen to varying levels in longline fishing techniques. These fishermen have expressed an interest in initiating longline operations.

Anguillian fishery officials are very impressed with the results of the Offshore Project. Returns on investment are a very respectable 19 percent. Fishery officials are especially interested in a possible longline fishery as it would relieve pressure on the heavily fished inshore stocks. The major impediment is the substantial investment required to initiate the fishery.[129] Some artisanal fishermen are considering it, but it is a major decision and they are hesitant, both because of the investment required and their lack of familiarity with longline techniques.[130]

British advisers recommend the expansion of Anguillian longline operations as well as the building a fish processing plant. The investors as of 1999 had made no commitments, primarily because longlining is an entirely new fishery for them and the substantial investment that will be required.[131] The fishermen were reportedly awaiting the final report by the British advisors and a decision by the British Government as to whether or not to continue technical support. The first year focused on the economic aspect of the fishery and the project managers hope to give more attention to the biological aspects if the program is extended.[132] Subsequent reports suggest that in 2000 a few fishermen had decided to enter the longline fishery.

A major issue associated with the development of the Anguillian fishing industry is the occasional hurricanes which wreak havoc on the island. This presents a major risk to the vessels and gear. While major hurricanes do not strike annually, they do strike often enough to be a major concern to fishermen investing in the industry. Major hurricanes have been reported at least once every 10 years and in some cases at even smaller intervals. The Anguillian fishery was hit especially hard by Hurricane Luis in 1995. This would have to be considered by island fishermen considering an investment in a longliner. The Government in 1995 gave no compensation for loss or damage sustained as a result of Hurricane Luis and maintains no insurance scheme for the fishermen. The Government did provide materials to replace lost and damaged gear.[133]

XIV. Research

There has been no research on swordfish or other oceanic pelagics conducted by Anguilla. Some research has, however been initiated in recent years:
ANT: The Anguillian National Trust was founded in 1986. A hurricane in 1995 caused such extensive damage that work was suspended, but resumed in 1996. Funding comes primarily from local businesses as well as some funds from the World Wildlife Foundation--UK. Their major current project is to renew Anguilla's sea turtle moratorium. They work with WIDECAST on the Anguilla's Sea Turtle Conservation Project. ANT is not only involved with protecting the turtles, but is also carrying out a research program.[134]
OFDP: The OFDP, however, has a research component and some of the fishing areas are selected based on the research requirements rather than strict fishery criteria. No papers have yet been published from the findings.[135] The OFDP has contracted a fisheries biologist working with Mac Alister Elliott and Partners in 1999 to assess the fisheries data from the project. He is helping the Anguillian Government prepare a fisheries management program and analyzing the data collected by the OFDP. He is reportedly having trouble getting the local fishermen to cooperate in his effort to help prepare a management plan.[136]

XV. Bycatch

A. Fishermen

1. Artisanal fishermen

Anguilla has had no swordfish fishery, thus there has been no resulting bycatch. Artisanal fishermen, however, have reported sporadic billfish catches. The last reported as of early 1996 was a 270 kg blue marlin taken in 1994.[137] The limited take of billfish has been due to the fishermen's limited range, coastal operations, and focus on gear and methods targeting primarily demersal species. The use of traps in particular preclude a billfish bycatch.

Bycatch data for Anguilla, as for other Caribbean islands, is very limited. Some idea of Caribbean bycatch trends are available by assessing the data reported by the U.S. longline fleet in its Caribbean operations (Caribbean Overview, series G appendices).[138] While this data does not pertain specifically to Anguillian waters or fishing strategies used by Anguillian fishermen, it does provide potentially useful benchmark data.

2. Offshore Fisheries Development Project

The OFDP initiated pelagic test longlining for oceanic pelagics in 1997. Project managers avoid the term bycatch at this time because they have not yet established which species should be targeted. Only limited information is available on the species generally classified as bycatch by many other Caribbean longline fishermen so the information provided by the OFDP provides valuable information on bycatch trends in the northeastern Caribbean.

B. Species

1. Billfish

OFDP officials report that billfish are being taken in the longline operations. The primary billfish taken is white marlin which reportedly account for about 16 percent of the longline landings (figure C) in experimental operations during 1998-99.[139] This is a substantial part of the catch and much larger than reported by U.S. fishermen in their overall longline operations (Caribbean Overview appendix G1a). The authors are unsure why the OFDP operations result in such a large catch of white marlin, however, the OFDP's tendency to set fairly close to Anguilla is probably a factor.

2. Tunas

OFDP officials report that tunas are being taken in the longline operations. The principal species being caught are yellowfin and bigeye. These two species accounted for 18 percent and 9 percent respectively of longline landings during the experimental operations conducted in 1998-99.[140] The tuna bycatch is also a very large part of the catch. It s nearly three times the catch levels reported by U.S. fishermen in their overall Caribbean fishery (Caribbean overview, appendix G2). The different results could reflect a variety of factors, especially varying methods and fishing strategies.

3. Sharks

OFDP officials report that sharks are being taken in the longline operations. Little data, however, has yet been released on the species and quantities being caught. The OFDP reports that sharks accounted for only 6 percent of the longline landings in experimental trials during 1998-99 (appendix C). Many sharks are, however, discarded at sea so the actual shark catch

composition is much larger. The sharks are discarded as there is little market for them in Anguilla. The sharks still alive are all released. Many of the landed sharks are distributed in port free to local people for "good public relations".[141] No data on the shark species is available. The authors note, however, that blue shark which account for the great bulk of the shark by catch in temperate waters are much less important in the Caribbean.[142]

Photo 19 --With these boats and the gear deployed, significant interactions with marine mammals and seabirds may be limited. Occasional turtles are encountered. D. Weidner

4. Other finfish

The only other finfish regularly reported by the OFDP is dorado or mahi-mahi ("dolphinfish"). It reportedly accounted for about 1 percent of the catch in experimental trials during 1998-99 (appendix C). Very small quantities of oilfish and ribbonfish are also taken.[143] These catch levels are much lower than those reported by U.S. fishermen in their overall Caribbean operations.

5. Turtles

Three species of turtles nest on Anguilla. Nesters are reported at four Anguillian bays. Most of the nesters are hawksbills with a smaller number of leatherbacks. Occasional loggerhead nests have also been reported. Green turtles forage around Anguilla, but do not nest. Nesting varies by species. The hawksbills are believed to nest from March to July. Hawksbills nest later in the year, usually from August to November.[144] Artisanal fishermen used to take turtles and would like to resume taking them if the moratorium was ended. The fishermen report spotting turtles, mostly hawksbills and greens, during fishing operations.[145] There are proponents of protecting the turtles among the fishermen, especially Ed Carty.[146]

No precise information is currently available on the number of nesters on Anguilla. The number of nesting females, however, is known to be very small. One now dated report suggests that only about 10 females were nesting. More recent observers estimate about six females making 30 nests, but this is a guess at best.[147] The Department of Fisheries and the Anguillian National Trust have organized a volunteer group to collect data. Neither environmental groups or the FD have the funds or staff to continually patrol the nesting beaches, but the Anguillian Sea Turtle Project does attempt to monitor the main beaches.[148] The Anguillian National Trust indicates that observers report on the nesting and cover the turtle tracks to make it difficult for the poachers to find the nests.[149]

The Government in 1995 implemented a 5-year moratorium on sea turtles harvests which expires in 2000.[150] The moratorium bans the capture of sea turtles for 5 years. It also bans the harvesting of turtle eggs for the same 5 years as well as puts an indefinite ban on the use of gillnets. The Government is currently considering another 5-year moratorium. The Anguilla National Trust is working with the Government to renew the moratorium. The Trust is associated with WIDECAST in its turtle protection work.[151] One of the regulations implemented in Anguilla to reduce bycatch levels is to limit fishing to "beach seeing" fishing. The fishermen are only allowed to deploy nets when they actually see fish and the nets can not be kept in the water for extended periods.[152] The turtle moratorium expires in 1999. Some fishermen are hoping that it may not be extended. Environmental groups believe that the Government will extend it, but are concerned that Government has not taken advantage of the moratorium to properly study the turtles nesting on Anguilla. They hope that more attention can be given to this when the moratorium is extended.[153]

Little information exists on fishery interactions with sea turtles. Fishermen do report occasional sightings of turtles, especially greens and hawksbills. Fishery officials believe that fishery interactions with turtles are now very limited.[154] Spear fishermen did not target turtles, but would take them if encountered.

As most fishermen set traps, there were few incidental captures, although before the moratorium they would take them with lines or other gear.[155] Since the moratorium this has ceased, except for a few taken illegally.[156] Environmental groups report that fishermen and other interested parties are increasingly reporting poaching incidents.[157]

A few turtles have been taken in the experimental longline fishery during 1998-99, including one leatherback which was released alive.[158] OFDP officials report that in 2 years of operations that they have observed turtles, but have yet killed one in their longline operations. Officials working with the OFDP report that in other fishing operations that they have also had few interactions with turtles, despite seeing numbers of them in the water off Anguilla.[159]

6. Marine mammals

The OFDP reports that they have interactions with marine mammals. There have, however, been no mortalities.[160] There have been reports of pilot whales feeding on baits and hooked fish. The fishermen believe that the pilot whales, when present, scare off fish and then reduce the catch taken in any set.[161]

7. Seabirds

There are important nesting colonies of seabirds on cays off Anguilla. Particularly important is Sombrero Cay. Many species of terns (Bridled, Gullbilled, Least, Roseate, Sandwich, and Sooty[162]), boobys, petreals, and other species nest on the cay. One 1984 report indicated that 10 species of seabirds nest on Anguilla and associated cays, especially Sombrero (appendix F).[163] Environmental groups are concerned about the development of a European satellite launching project currently under consideration.[164] Project coordinators insist that there will be no significant negative impact on bird colonies, although there may be minimal impacts on launch days.

No information exists on Anguillian fishery interactions with seabirds.[165] Fishery officials know of no such significant interactions, although fishermen are known to use the presence of seabirds as an indicator as to where fish may be present.[166]

The OFDP master fishermen uses the presence of seabirds as one indicator as to where the longline should be set. OFDP officials, however, report that in 2 years of operations they have noted virtually no seabird interactions resulting in mortalities as a result of longline operations. Officials estimate that there may be one mortality annually. The fishermen do observe seabirds, but the birds do not seem to follow the longliners and there are very limited interactions.[167]

XVI. International

A. Relations

1. Multilateral

The major multilateral organization involved with oceanic pelagics in the Atlantic is the International Commission for the Conservation of Atlantic Tunas (ICCAT). Some regional organizations also are involved with fisheries.

OECS: Anguilla joined the Organization of Eastern Caribbean States (OECS) as an associate member in 1995, the same status as the nearby British Virgin Islands (BVI). OECS has given considerable attention to fisheries and has a Natural Resources and Fisheries Unit.[168] OECS used to be more active in fisheries, but it continues to be an area of concern. One major issue is the possible creation of a common fisheries zone. The project is complicated by the French territories (Guadeloupe and Martinique) which cut the potential OECS fisheries zone into three separate areas. Unlike many multilateral organizations, dependent territories participate as full members in OECS, including Anguilla, BVI, and Montserrat. One possible option for the smaller Caribbean countries interested in participating in ICCAT is to work through OECS. OECS has, however, to date played a very limited role at ICCAT. Some Anguillian observers are not optimistic that OECS could actively support their interests. Others are more optimistic about OECS's ability to address regional fishery problems.[169] The OECS is generally dominated by four members, Dominica, Grenada, St. Lucia, and St. Vincent. The Japanese have active fishery development projects in these countries. There are also non-fishery Taiwan aid projects on some islands. Thus local observers speculate that these countries may not be motivated to take strong stands on issues to which the Japanese delegation and Taiwan observers object to. This may also prevent OECS from coordinating a Caribbean approach to the extensive transhipping operations in Trinidad and St. Maarten.[170]

ICCAT: The International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for international coordination of research on and management of tuna and tuna-like species in the Atlantic, including swordfish. ICCAT has established

catch limits and a variety of other conservation and management measures for many of the species under its purview. As a U.K. Overseas Territory, Anguillian interests are represented by the United Kingdom which is an ICCAT member.[171] The U.K. interest in ICCAT, during past years, however, has focused primarily focused on Bermuda and St. Helena. Until recently, Anguilla has had little interest in participating actively in ICCAT because it did not had an active longline fishery and take meaningful quantities of large oceanic pelagics. The AFMRD's acquisition of a longliner in 1998 and ensuing test fishing has resulted in catches of these species. Anguillian officials were aware of the need to participate in the ICCAT management plan for swordfish and other species.[172] The AFMRD asked the British Government to apply for the appropriate ICCAT swordfish and tuna quotas. The process was delayed by an election and change of administration in Anguilla. The Anguillians are also concerned about ICCAT fees.[173] The cost of participating in multilateral organizations like ICCAT, even as an observer, is a major impediment for a small territory like Anguilla. Anguillian sources report in mid-2000 that they have in practical terms "joined ICCAT through the United Kingdom". Their dues have been paid and the AFMRD will have a reporting program in place and, as a result, they have received a small catch allocation from ICCAT.[174] ICCAT, in fact, changed its quota table from an entry for Bermuda to an entry for "UK Overseas Territories". UK officials can thus distribute its annual 2000-2002 quotas of 24 t as it sees fit to its different Overseas Territories (Caribbean Overview, appendix H3b).[175] No information is available to the authors as to precisely how much of that quota has been assigned to Anguilla.[176] The overall UK Overseas Territory quota is subject to future proportional adjustments should ICCAT alter the overall north Atlantic swordfish catch allocations.

2. Bilateral

Anguilla's principal bilateral fishery relationship is with St. Martin and primarily concerns artisanal fisheries. Several of the major foreign countries operating longliners in the Atlantic report operations off Anguilla.

Cuba: Cuban longliners have primarily been deployed off West Africa. There has been some Cuban activity in the Wider-Caribbean (Caribbean Overview, appendix D3). There has not, however, been any Cuban longlining immediately around Anguilla (appendix D).

European Union: Anguillian officials report that European Union (EU) officials have expressed some interest in access to Anguillian grounds for the fishermen of member states. Such opportunities have not yet been explored in detail.[177]

Japan: Japan has deployed the largest longline fleet in the Atlantic. The Japanese reported catches off Anguilla and the other Caribbean islands in the northeastern Caribbean as early as 1961 (appendix D). Japanese swordfish bycatches have generally been modest although in 1966 13.9 t were taken in the ICCAT 5° square encompassing Anguilla. The last fishing in this area reported by the Japanese was noted in 1974 (appendix D). The Japanese have reported no billfish and other swordfish fishing off Anguilla in recent years.[178] Anguilla officials, however, report Japanese longliners operating in the western Atlantic about 300 km north of Anguilla and targeting swordfish, tuna, and bonito.[179] Anguillian fishermen have been reporting sightings of the Japanese vessels for years, although they often refer to all large Asian longliners as Japanese vessels.[180] Unlike the independent island countries, there is no Japanese assistance program on Anguilla.

Korea: Korea also deployed a major Atlantic longline fleet. Operations off Anguilla has never been extensive, but the Koreans did take 8.1 t of swordfish during 1978. No catches have been reported since 1986 (appendix D).

Spain: Spanish fishermen do not operate in the Wider-Caribbean (Caribbean Overview, appendix D6). This of course includes the area around Anguilla (appendix D). Spanish fishermen have reported no swordfish fishing off Anguilla.[181] Enforcement officials and local fishermen do not report sighting Spanish longliners.

St. Martin: Anguilla's principal bilateral fishery relationship is with the nearby French island of St. Martin. Fisheries cooperation is close, although fishery authorities have not yet succeeded in coordinating regulations.[182] Cooperation primarily concerns artisanal fisheries. Cooperation is in part so close because many families span the two islands. The family connections, in fact, sometime make it difficult to determine who is who. French authorities provide access to the fisheries market on St. Martin for the Anguillian fishermen. This has been important as until recently, the Anguillian tourist industry had not developed in a major way. Thus the Anguillian fishermen greatly benefitted from access to the much larger market on St. Martin. Anguilla in turn provided access to its grounds for some St. Martin fishermen, an important opportunity as St. Martin own waters are heavily fished.[183] Some Anguillian fishermen are critical of the French on St. Martin and Guadeloupe saying that they let their fishermen use small 1 inch (in) mesh which has devastated their resource and as a result the French fishermen want to fish off Anguilla. Anguillian waters are not as heavily fished because of the smaller number of fishermen and the larger mesh

(1½ in) employed.[184] Anguillian enforcement officials complain, however, that the St. Martin fishermen often do not get the needed licenses or comply with Anguillian gear regulations. They also note that constantly changing personnel, as a result of French rotational assignments, make it difficult to establish close ties with officials on St. Martin.[185]

St. Maarten: Anguillian officials report much more limited exchanges with Dutch officials on St. Maarten. The Dutch fishery is less developed and their are fewer family ties with Anguillians.[186] As it is the French side of the island that faces Anguilla and most of the tourist development us on the French side, the primary fishery relationship has been with the French.

Taiwan: Taiwan, like the Japanese, initiated Caribbean-area longline operations in the 1960s. The primary Taiwan activity has been to the north of the Caribbean, as far as Bermuda, where they have targeted albacore to supply Puerto Rican canneries packing "white meat" tuna.[187] Many of the vessels have operated out of St. Maarten.[188] Available evidence suggests that Taiwan longliners are not extensively fishing Caribbean waters, but are using Caribbean ports to transship their catch and maintain their fleet. Representatives of the Nichirei Carib Corporation who operate the Taiwan fleet have told British officials that access to BVI and Anguillian waters would be desirable, but not essential for their operations.[189] Taiwan vessels in the mid-1980s began expanding transshipping activities out of Port-of-Spain.[190] The vessels, however, do not appear to be the longliners targeting albacore to the north of the Caribbean. The Taiwan fishermen do not appear to be very active in the Caribbean basin itself, but have been known to opportunistically in waters adjacent to Anguilla and other U.K. dependent territories while in transit between their fishing grounds and Caribbean transshipment points. As a result, substantial Taiwan fishing does occur in or near the Antillian Arc. Taiwan fishing in the area immediately around Anguilla was first reported in 1968. The Taiwan fishermen were fairly active from then through 1987, but then did not report activities again until 1995. Taiwan operations are highly seasonal. They are most active in the second quarter of the year and to a lesser extent the third quarter (appendix D). The seasonality of operations is determined by the availability of the target tuna species and not swordfish. In the case of Anguilla, this would appear to be primarily the vessels utilizing the transshipment facilities at nearby St. Maarten. Anguillian fishermen do report seeing them passing through and making sets in Anguillian waters.[191] There have been occasional seizures of Taiwan longliners by the Marine Department (MD) of the Anguillian Police Force. (See "Enforcement".) Anguillian fishermen tend to refer to all the Asian longline vessels as Japanese longliners. Thus it is sometimes confusing as to whether they are referring to Japanese or Taiwan vessels.

United States: The United States began developing a longline fleet targeting yellowfin tuna in the Gulf of Mexico. U.S. longline fishermen began targeting swordfish in the mid-1980s after commercial stocks were encountered off the Florida Atlantic coast.[192] A small number of the U.S. swordfish/tuna longliners are active in the wider-Caribbean, including grounds to the north and east of Puerto Rico. The U.S. fishery is highly seasonal, primarily conducted during the winter months. U.S. pelagic longline fishermen in the Caribbean often fish in the northeastern Caribbean, but generally to the southeast of Puerto Rico, south of Anguilla or north and northeast in the Atlantic. Anguillian officials report occasionally spotting U.S. longliners.[193] There also is some fishing north and northeast of Anguilla, but generally outside of Anguillian waters.[194]

Photo 20.--This pier at Sandy Bottom is the dock used by the OFDP for the Axa Fishtec and by the Marine Patrol. Dennis Weidner

B. Joint ventures

There are no known fishery joint ventures on Anguilla.

XVII. Enforcement

Anguilla, while not an independent country--like the other U.K. Overseas Territories, has the legal right to control foreign fishing in their EEZs. This includes longline fisheries for oceanic pelagics in offshore waters. In practical terms, however, the islands find monitoring foreign fishing activities difficult, especially beyond the coastal areas where Anguillian artisanal fishermen operate. There is almost no Anguillian presence in the outer limits of their EEZs.

A. Capability

Anguilla has a very limited marine enforcement capability. There is a dedicated marine section within the police department which conducts fisheries enforcement and other coast guard functions. This allows the officers to specialize in marine patrol and provides for continuity and team building. The personnel have been trained to a high standard by the Royal Navy and the Canadian Coast Guard.[195] The Marine Department (MD) of the Anguillian Police Force has seven marine officers and a office and pier at Sandy Ground. They operate a launch, the *Dolphin*, and a Boston whaler for inshore patrols.[196] There is only one crew which restricts the MD to one watch. Patrols were conducted 3-4 times a week, but in 1999 2 per week were more common.[197] These patrols usually last 3-4 hours and are normally restricted to inshore waters.[198] Additional operations in offshore waters are possible, but the cost would be very high. Not only would already expensive vessel operating costs increase, but additional personnel to form a second crew would be required.

The MD is involved with search and rescue, police functions, fisheries enforcement, and customs. Much of the FD's work is fisheries enforcement. When on fishery patrols the FD adds a Fisheries Officer from the Fisheries Division.[199] The patrol boat *Dolphin* was provided by the British. Training is offered on the island and on Antigua, a larger British colony, through the British Military Advisory Training Team (BMATT). Royal Navy ships occasionally visit and provide the opportunity for longer distance patrols. Often ship helicopters are used for offshore patrols into areas not normally covered.[200]

B. Countries

The MD deals with both fishermen from neighboring islands as well as distant-water fishermen.

1. Neighboring islands

The major enforcement problem on Anguilla is poaching by fishermen from St. Martin. The two islands are very close. Some licenses are issued to St. Martin fishermen, because of the market access given to Anguillian fishermen by French officials on St. Martin. OECS notes, "The informal agreements between St. Martin and Anguilla reflect a long-standing relationship of reciprocity between the two states."[201] Anguillian fishery officials report,

Photo 21.--Anguilla's Marine patrol boat is moored by the Marine Police station at Sandy Bottom. Dennis Weidner

however, that illegal fishing is occurring.[202] While the boats come from St. Martin and St. Maarten, many of the fishermen are Haitians or Dominicans. These fishermen are being hired by boat owners as they are willing to work for less than St. Martin fishermen.[203] The FD uses some judgement with these fishermen. If only a few fish are involved they get off with a warning. Fishermen with appreciable numbers of fish are arrested. Severe violations may involve the loss of the boat. Almost always these incidents involve St. Martin/St. Maarten boats. Anguillian fishermen usually do not leave Anguillian waters.[204]

Photo 22.--Anguilla has a professional Marine Police force which has been trained by the Royal Navy. Dennis Weidner

2. Distant water countries

A British study reports that there is reason to believe that illegal foreign fishing occurs from time to time.[205] Enforcement officials have reported relatively few seizures of foreign longliners, primarily Taiwan vessels. This may in part be because that enforcement patrols generally do not extend much north of Sombrero Cay.[206] Local fishermen report sightings of foreign fishermen and complain that their fixed gear is lost or damaged because of cut ropes.[207]

Officials report only a few incidents with foreign fishermen in recent years. The number of seizures does not indicate extensive foreign fishing in Anguillian waters, but Anguillian officials believe that if extensive surveillance was possible that several more foreign vessels would have been seized.

a. Taiwan

Taiwan longliners moving to and from the transshipment facilities on nearby St. Maarten have set in Anguillian waters. They have also damaged gear and pulled traps set by local Anguillian fishermen. These and other problems reportedly caused much ill feeling will among local fishermen with the Nichirei Carib Corporation which contracts the longliners.[208]

Anguillian authorities have seized three Taiwan longliners and fined the vessels. The three vessels were part of the Taiwan fleet operating out of St. Maarten. At the time of seizure both vessels had substantial quantities of frozen fish.[209] Enforcement officials report the vessels had both frozen tuna and swordfish, as well as shark fins and jaws.[210] The vessels also had lobsters aboard indicating that they were pulling the traps of the local Anguillian fishermen.[211]

Hwa Yow 16: The *Hwa Yow 16* was seized in April 1991 about 4.5 km off Scrub Cay. At the time of seizure the longliner had 120 t of frozen fish aboard. It looked to be mostly yellowfin tuna, although it was hard to tell because the hold was full. There were also some marlins and swordfish. The vessel was fined $250,000 (for the boat) and $250,000 (for the catch).[212] One vessel and the catch was confiscated and sold at auction. The Taiwan owners purchased it back without much other bidding to compete against.[213] Some of the catch was distributed locally.[214]

Unknown vessel: Another Taiwan longliner was seized about 110 km north of Anguilla.[215] The date of this seizure is unavailable.

Unknown vessel: One Taiwan longliners run aground in Anguillian waters. Details on this incident are unavailable, but it appears to have occurred in the 1980s.

The Taiwan longliners appear to be directed from a Taiwan headquarters. The vessels that were seized by the Anguillians first contacted Taiwan and then their

agent on St. Maarten.[216] The Taiwan captain seemed unaware that they were violating Anguillian law. After the seizures the Taiwan longliners modified their operations. They no longer set close to the island as they had commonly done before the seizures. Thus Anguillian officials now have little information on Taiwan activities in the area.[217]

b. Venezuela

A Venezuelan-flag boat, the *Chimana Chia*, with a Korean crew was seized in October 1995. The fish were in refrigerated seawater and were mostly tuna, yellowfin and bigeye. The captain had been told to avoid U.S. waters, but apparently did not think he would be seized in the waters off Anguilla and neighboring islands.[218]

XVIII. Future Trends

Anguillian fishermen have not conducted pelagic longline operations. The fishing industry on Anguilla is an artisanal activity, primarily focused on supplying tourists and restaurants. Much of the catch was sold on nearby St. Martin, but increasing quantities are being marketed on Anguilla itself. This trend of directing more product to the domestic market is expected to persist as Anguillian companies improve marketing practices and the islands' tourist industry continues to expand. The local artisanal fishermen are, however, unable to supply the diversity of species required by the substantial demands of the island's expanding tourist industry--thus importing seafood will continue to be necessary.

Anguillian fishermen have not operated any commercial longliners. Fishery officials have, however, conducted a test fishing project to assess the feasibility of oceanic longlining out of Anguilla. Test fishing using longline gear was initiated in 1998 by the Offshore Fisheries Development Project (OFDP). The test fishing project landed swordfish and other large pelagics in quantity for the first time. The OFDP longlining is a test development project financed by the British Government.

Project managers are now attempting to shift the project to a commercial undertaking. There is reportedly considerable interest on the part of the fisherman and investors in initiating a small longline operation in Anguilla. Three fishermen in 2000 have decided to enter the longline fishery. Actual fishing operations are expected to begin in 2000-2001. Some fishermen are considering operating a longliner while other fishermen are considering adding longline gear to their existing boats and combining longline operations with their current trap fishing.

An assessment prepared by British advisers show strong local and regional markets for fish that are expected to expand. This local demand as well as the nearby U.S. market provide a ready market for any future longline operation. Planners now envision a modest fleet of about five small or medium sized longliners supplying a processing plant to supply local, regional, and international markets. A number of problems remain to be overcome. The need to obtain financing, lack of experience with longlining, and unfamiliarity with export marketing are all problems which will have to be addressed for the Anguilla's new longline fishery to succeed.

* * * *

Note: This chapter was designed and formatted by Vanessa Starks, a senior at Laurel High School in Laurel, Maryland. She also prepared the computer graphics. Ms. Starks worked with the National Marine Fisheries Service through the Oak Ridge Institute of Science Education (ORISE) program. She hopes to pursue a career in marine biology or medicine.

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5. Sam Webster, personal communications, September 30, 1999; Claude Richardson, personal communications, September 30, 1999; and Ed Carty, personal communications, October 1, 2000.
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7. OECS, "Draft plan ...," *op. cit.*, p. 3-5.
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10. Sam Webster, Anguillian fisherman, personal communications, September 30, 1999.
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24. Richardson, "Status ...," *op. cit.*, p. 31.
25. OECS, "Draft plan ...," *op. cit.*
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27. Hodge, *op. cit.*, April 27, 1999.
28. Lee, "Presentation ...," *op. cit.*

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92. OECS, "Draft plan ...," *op. cit.*, p. 6.
93. L. Carty, *op. cit.*, January 18, 1996.
94. Richardson, "Status ...," *op. cit.*, p. 32.
95. Lee, *op. cit.*, April 23, 1999 and Hodge, *op. cit.*, April 27, 1999.
96. E. Carty, *op. cit.*, October 1, 1999.
97. OECS, "Draft plan ..., " *op. cit.*, May 24, 2000.
98. Richardson, "Status ...," *op. cit.*, p. 32.
99. L. Carty, *op. cit.*, January 18, 1996.
100. Lee, "Presentation ...," April 1999.
101. Hodge, *op. cit.,* April 27, 1999.
102. Farber, *op. cit.*, May 9, 2000.
103. See the Trinidad chapter of this report for details.
104. Richardson, *op. cit.*, September 30, 1999.

SECTION XIII. (Government Policy)

105. Hodge, *op. cit.,* April 27, 1999.
106. Lee, "Presentation ...," *op. cit.*
107. The unit of currency in Anguilla and many other of the small Caribbean islands that are British dependencies or former colonies use the Eastern Caribbean dollar (EC$).
108. AFMRD officials report that they have some difficulty regulating both the local and French sport fishermen because some try to land their catch for sale. Apparently some have been denied commercial fishing licenses and are using sport licenses to gain access to the resource. Hodge, *op. cit.*, April 27, 1999.
109. E. Carty, *op. cit.*, October 1, 2000.
110. MRAG, "Large pelagic fisheries ..., *op. cit.*, p. 81.
111. Vanderpool, *op. cit.*, September 30, 1999.
112. MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 81.
113. Lee, "Presentation ...," *op. cit.*
114. Territorial Waters Jurisdiction Act, 1878.
115. Proclamation No. 28, November 6, 1981.
116. U.S. Department of State, "United States-United Kingdom maritime boundaries in the Caribbean," *Limits in the Seas*, No. 115, April 11, 1994.
117. Lee, *op. cit.*, June 1, 1999.
118. Lee, "Presentation ...," *op. cit.*
119. E. Carter, *op. cit.*, October 1, 1999.
120. Webster, *op. cit.*, October 1, 1999.
121. Hodge, *op. cit.*, October 1, 1999.
122. Hodge, *op. cit.*, April 27, 1999.
123. Richardson, "Status ...," *op. cit.*, pp. 31-32.
124. Elvett Hughes, Permanent Secretary for Natural Resources, personal communications, September 30, 2000.
125. Hodge, *op. cit.*, October 1, 1999.
126. Mahon, *op. cit.*, February 13, 1996.
127. Lee, *op. cit.*, April 23, 1999.
128. Hodge, *op. cit.*, April 27, 1999.
129. Hodge, *op. cit.*, September 30, 2000.
130. Webster, *op. cit.*, September 30, 1999 and C. Richardson, *op. cit.*, September 30, 1999.
131. Vanderpool, *op. cit.*, September 30, 1999.
132. Lee, "Presentation ...," *op. cit.* and Lee, *op. cit.*, June 4, 1999.
133. OECS, "Draft plan ...," *op. cit.*, p. 3.

SECTION XIV. (Research)

134. Ijahnya Christian, Executive Director, Anguillian National Trust, personal communications, June 2, 1999.
135. Lee, *op. cit.*, June 1, 1999.
136. Lee, *op. cit.*, June 4, 1999.

SECTION XV. (Bycatch)

137. L. Carty, *op. cit.*, January 18, 1996.
138. U.S. Caribbean bycatch data is summarized in the Puerto Rican chapter of this report.
139. Lee, *op, cit,* June 1, 1999.
140. Lee, *op, cit,* June 1, 1999.
141. Lee, *op, cit,* May 6, 1999.
142. The available information on the bycatch of the U.S. fleet suggests that blue shark catch rates in the Caribbean can be only 10 percent of those reported on more northerly grounds. Jean Cramer, "By-catch of blue sharks (*Prionace glauca*) reported by the U.S. pelagic fleet from 1987-1995," *ICCAT Collected Volume of Scientific Papers*, XLVI (4), pp. 456-467. Details on the bycatch of the U.S. fleet's Caribbean operations are summarized in the Puerto Rican chapter of this report. Blue shark catch rates are also higher on more southerly grounds. See the Brazilian and Uruguayan chapters of this report for details.

143. Lee, *op.cit.*, June 1, 1999.
144. "Ecological corner: Don't touch those eggs," *Trust News*, August 1, 1998.
145. Webster and Richardson, *op. cit.*, September 30, 1999.
146. R. Connor and J. Connor, "Anguilla's Sea Turtle Project," *op. cit.*
147. Rhon and Jacqueline Connor, "Anguilla's Seat Turtle Project," Anguilla National Trust, Anguillian National Trust.
148. Rhon and Jackie Connor, "Turtle Research Project", Anguillian Sea Turtle Project, October 1998.
149. Ijahnya Christian, Executive Director, Anguillian National Trust, personal communications, September 29, 1999.
150. The Government with SRO #4 on May 31, 1995 amended section 18 of the Fisheries Protection Regulations of 1988.
151. Christian, *op. cit.*, June 2, 1999.
152. Lee, *op. cit.*, June 1, 1999.
153. Christian, *op. cit.*, September 29, 1999.
154. Vanderpool, *op. cit.*, September 29, 1999.
155. Webster, *op. cit.*, September 30, 2000.
156. Vanderpool, *op. cit.*, September 29, 1999.
157. Christian, *op. cit.*, September 29, 1999.
158. Hodge, *op. cit.*, September 30, 1999.
159. Lee, *op, cit,* May 6, 1999.
160. Lee, *op. cit.*, June 1, 1999.
161. Hodge, *op. cit.*, September 30, 1999.
162. The convention for fish species is to not capitalize species common names such as swordfish or yellowfin tuna. The convention among ornithologists, however, is to capitalize the common names such as Brown Noddies. Thus the common names of fish and seabirds are handled differently in this report.
163. Ruud van Halewyn and Robert L. Norton, "The status and conservation of seabirds in the Caribbean," in J.P. Croxall, P.G.H. Evans, and R.W. Schreiber (eds.), "Status and conservation of the world's seabirds," *ICBP Technical Publication*, No. 2 (ICBP: Cambridge, 1984), pp. 175-176.
164. Christian, *op. cit.*, September 29, 1999.
165. Christian, *op. cit.*, September 29, 1999.
166. Vanderpool, *op. cit.*, September 29, 1999.
167. Lee, *op, cit,* May 6, 1999.

SECTION XVI. (International)

168. For details on the OECS fishery related activities, see the Caribbean Overview of this report.
169. Hodge, *op. cit.*, October 1, 1999.
170. For details see the individual island reports.
171. Individual European Union members are no longer ICCAT members. It was agreed at the 1997 annual ICCAT meeting that all EC Member States would withdraw from the Commission effective December 31, 1997. The sole exceptions were France and the United Kingdom which then rejoined in respect of their overseas territories.
172. Walcott A. Richardson, Parliamentary Secretary for Agriculture, Fisheries, and Environment, personal communications, October 1, 1999.
173. Hodge, *op. cit.*, April 27, 1999.
174. Lee, *op. cit.*, June 8, 2000.
175. The Overseas Territories which have small fisheries targeting swordfish in the Atlantic include Anguilla, Bermuda, the British Virgin Islands, and St. Helena. St. Helena is located in the south Atlantic and therefore would not share in the 24 t north Atlantic quota. Other U.K. Overseas Territories in the wider-Caribbean such as the Cayman Islands, Montserrat, and the Turks and Caicos do not currently have fisheries reporting swordfish catches. See the individual island reports for details.
176. The quotas in recent years have been: 1997 (28 t), 1998 (27 t), and 1999 (27 t). The projected 2000-2002 quotas are 24 t, but as mentioned above, this would be changed proportionally if ICCAT decides to reduce or increase the overall north Atlantic quota for all countries.
177. Hodge, *op. cit.*, September 29, 1999.
178. See for example Uozumi, "Preliminary analysis ...," *op. cit.*, p. 29 and ICCAT, "1994 SWO background document: Figures," *ICCAT Collective Volume of Scientific Papers* (ICCAT: Madrid, Spain, 1995), p. 91.

179. L. Carty, *op. cit.*, January 18, 1996.
180. E. Carty, *op. cit.*, January 18, 1996.
181. See for example ICCAT, "1994 SWO background document: Figures," *op. cit.*, p. 91.
182. Hodge, *op. cit.*, September 30, 1999.
183. Vanderpool, *op. cit.*, September 29, 1999.
184. E. Carty, *op. cit.*, October 1, 1999.
185. Proctor, *op. cit.*, September 29, 1999.
186. Hodge, *op. cit.*, September 30, 2000.
187. See the Bermuda chapter of this report for more details.
188. For details see the St. Maarten chapter of this report.
189. British officials with Mr. Hashitani at the Nichirei carib Corporation. "Large pelagic fisheries ..., *op. cit.*, p. 6.
190. For details see the Trinidadian chapter of this report.
191. Carter, *op. cit.*, October 1, 1999.
192. Details on the U.S. swordfish fishery are available in Karyl K. Brewster-Geisz, "United States," *World Swordfish Fisheries*, Vol. V. (NMFS: Silver Spring, Maryland), pp. 63-102.
193. Hodge, *op. cit.*, September 30, 1999.
194. Jean Cramer and Heather Adams, "Large pelagic logbook newsletter - 1996," *NOAA Technical Memorandum* (NMFS-SEFSC-407), January 1998, p. 3 and Jean Cramer, "Large pelagic logbook newsletter - 1995," *NOAA Technical Memorandum* NMFS-SEFSC-394, November, 1996, p. 3.

SECTION XVII. (Enforcement)

195. MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 83.
196. Proctor, *op. cit.*, September 30, 1999.
197. Sgt. Evensley Browing, Police Marine Unit, personal communications, September 30, 1999.
198. MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 83.
199. Vanderpool, *op. cit.*, September 30, 1999.
200. Proctor, *op. cit.*, September 30, 1999.
201. OECS, "Draft plan ...," *op. cit.*, p. 6.
202. Vanderpool, *op. cit.*, September 30, 1999.
203. Browning, *op. cit.*, September 30, 1999.
204. Proctor, *op. cit.*, September 30, 1999.
205. "Large pelagic fisheries ..., *op. cit.*, p. 6.
206. Proctor, *op. cit.*, September 30, 1999.
207. Richardson, "Status ...," *op. cit.*, p. 32.
208. MRAG, "Large pelagic fisheries, *op. cit.*, p. 81.
209. Hodge, *op. cit.*, September 29, 1999.
210. Browning, *op. cit.*, September 30, 1999.
211. Hodge, *op. cit.*, October 1, 1999.
212. Lee, *op. cit.*, April 23, 1999.
213. Hodge, *op. cit.*, October 1, 1999.
214. Vanderpool, *op. cit.*, September 30, 1999.
215. Proctor, *op. cit.*, September 30, 1999.
216. Proctor, *op. cit.*, September 30, 1999.
217. Hodge, *op. cit.*, September 30, 2000.
218. Hodge, *op. cit.*, April 27, 1999.

Appendices

Series A: Catch
Series B: Fleet Operations
Series C: Species Composition
Series D: Foreign Fishing
Series E: Trade
Series F: Bycatch

Appendix A1.--Anguilla. Fisheries catch, 1980-96

Year	Catch
	Metric tons
1980	NA
1981	NA
1982	NA
1983	NA
1984	NA
1985	NA
1986	NA
1987	419
1988	397
1989	374
1990	350
1991	351
1992	386
1993	330
1994	333
1995	350
1996	340
1997	360

Source: FAO, *Yearbook of Fishery Statistics*, (FAO: Rome, various years).

Appendix A2.--Anguilla. Swordfish catch, 1990-98

Year	Catch		
	FAO	ICCAT	OFDP*
		Metric tons	
1990	NA	NA	-
1991	NA	NA	-
1992	NA	NA	-
1993	NA	NA	-
1994	NA	NA	-
1995	NA	NA	-
1996	NA	NA	-
1997	NA	NA	-
1998	NA	NA	6
1999	NA	NA	3

* NMFS estimate based on OFDP data.
NA - Not available
Source: FAO, *Yearbook of Fishery Statistics*, various years; ICCAT, *Statistical Yearbook*, various years; and U.S. Bureau of the Census, unpublished data.

Appendix B1.--Anguilla. Set strategies, 1998-99

Element	Target species	
	Swordfish	Tuna
Set		
Start	5:30 pm	5:30 am
Finish	9:30 pm	9:30 am
Haul		
Start	6:30 am	4:30 pm
Finish	12:00	11:00 pm
Soak time	9 hours	7 hours
Lighting		
Marker	No	Yes
Sticks	Yes	No
Deck	No	Yes

Source: Captain Robert Lee, "Anguilla Offshore Development Project: Report of Masterfisherman, April 1999, p. 16.

Appendix B2.--Anguilla. Handling procedures, 1998-99

Species	Step				
	Headed	Gutted	Gilled	Iced belly	Finned
Swordfish	Yes	Yes	Yes	Yes	Yes
Tunas					
Yellowfin	No	Yes	Yes	Yes	Yes
Small	No	Yes	Yes	Yes	Yes
Marlin	Yes	Yes	Yes	Yes	Yes
Shark	Yes	Yes	Yes	Yes	Yes
Dorado	No	Yes	Yes	Yes	Yes

Source: Captain Robert Lee, "Anguilla Offshore Development Project: Report of Masterfisherman, April 1999, p. 21.

Appendix B3.--Anguilla. Fishing results, 1998-99

Element	Result
Trips	37
Sets	85
Hooks	629 per set*
Line	41.7 km
Catch/effort	
Sets	211 kg per set*
Hooks	336 kg per 1,000 hooks*
Income	$1,342 per set*
Expenses	$ 606 per set*
Prices	$6.35 per kg*

* Averages
Source: Captain Robert Lee, "Anguilla Offshore Development Project: Report of Masterfisherman, April 1999, p. 23.

Appendix B4.--Anguilla. OFDP duties and responsibilities of crew members

Post: **Vessel Captain**

1. To ensure the safe navigation and mooring of the vessel at all times.
2. Responsible for the keeping of the fishing and navigation logs.
3. Ensure the proper maintenance and operation of the vessel
4. Ensure that the crew is trained in the use of all safety and emergency equipment.
5. Take the vessel to the fishing grounds and fish as directed by the shore base.
6. Responsible for the dry-docking and seek the interest of the owner at all times
7. Responsible for the hiring and discipline of the crew.
8. Responsible for preparation of the crew shares and offloading and proper storage of the fish aboard the vessel.

Post: **Vessel Engineer**

1. Secure the efficient mechanical operations of the fishing vessel and it's equipment.
2. Give basic training to new fishermen on preventive maintenance and simple repairs to engines.
3. Carry out the routine preventive maintenance of the main propulsion engines, generators, deck machinery and any refrigeration equipment.
4. Assist in all fishing operations.
5. Ensure an adequate supply of fuel, lubricants, spares and tools necessary for the sailing plans.
6. Keeping the daily log of the engines, generator and all equipment.
7. Assist in the dry docking and all repairs of the engine and hull.
8. Maintain a high level of cleanliness in the engine room.
9. Assist in the cleaning of the vessel.

Post: **Vessel Mate**

9. To take charge of the Navigation Watches
10. To train the fishermen in Watch Keeping Duties and seamanship.
11. To be responsible for the operation of the fishing gear and it's maintenance.
12. To be responsible for the cleaning, secure storage of the fish catches
13. To be responsible for the loading and offloading procedures.
14. Assist in all fishing operations.
15. To manoeuvre the vessel in the absence of the Captain.
16. To be responsible for the cleaning of the fish hold.
17. To supervise the crew in the cleaning of the deck, cabin, crew quarters and head.

Source: Robert Lee, "Anguilla Offshore Fisheries Development Project: Report of Masterfisherman," April 1999.

Appendix B5.--Anguilla. OFDP--List of equipment aboard a mid-size longliner

Quantity	Equipment
1	36" x 48" Super Spool
1	24" x 13" Leader Cart Stand Only
1	24" x 13" Spool Only, Solid
3	4" Hauling Block
2	Leader/ Hook Line Tubs
1,500 lb.	L/P Main Line per lb.
200 lb.	L/P Leader Line per lb.
Tackle	
8,000	Crimps, "D" Aluminium
500	Crimps, 5/32" Aluminium
6	Dexter Slime Knife # S-125
6	Dexter Stiff Boner # S-136 N
2	Meat Saws
12	Spare Blades (meat saw)
10	Floats, LD-2 (12" x 23")
10	Floats, LD-3 (14" x 30")
150	Bullet Buoy 7" x 14"
1	Gaff, 3" x3/8 x 6' #366- H
1	Gaff, 3" x3/8 x 8' #368- H
1	Gaff, 4" x3/8 x 6' #466- H
2	Gaff, 5" x1/2 x 6' #586- H
1	Meat Hook 30" x 5/8"
1	Meat Hook 18" x 5/8"
2	Box Hooks 24"
1,000	Mustad Hook 7698 R 9/0
1,000	Spring Loop Protectors (500 per bag)
4	Complete Hy-Flyer Assembly
8,000	LP 4" Light Sticks
1,000	Snap #148 w/8/0 swivel
6	Wire Brush, Stainless Steel (long)
1	Crimping Tool, Bench Mnt.
1	Hand Crimp Tool, Standard
6	Duct Tape (roll)
12	Atlas Work Glove
4	Ice Gloves, 18"
12	Gloves, Nylon Orange, (dozen)
6	Manley, 7" Mono Cutter
2	Tarred Line, 6.4 mm, 550 meters
2	(Case of 72) D-Cell Alkaline Batt.
6	OPI Strobe Light (2 D- cell)
Electronics	
1	Surface Temp Unit #ATA 128 A
1	Taiyo Auto. Direction Finder #TD- L1100
4	OPI Beeper Buoy with Antenna
	SPARE PARTS
1	Standard Spare Parts Kit

Source: Robert Lee, "Anguilla Offshore Fisheries Development Project: Report of Masterfisherman," April 1999.

Appendix B6.--Anguilla. OFDP--Daily summary of fishing operations

SET												
Date	Time Start	Time Finish	Set Lat.	Set Long	Wind Sp.	Wind Dir	Set Dir	Nr. Hooks	Leader	Drops	Bait1 Qty	Bait2 Qty
26/05/99	17:45	21:10	N19 09	W63 04.7	12	E	NW	696	18	18	240Lbs	
		Finish Set:	N19 18.6	W63 31								

HAUL											
Date	Time Start	Time Finish	Haul Lat.	Haul Long.	Wind Sp.	Wind Dir	Haul Dir	SST	Moon	Line Length	L.Sticks
27/05/99	6:10	11:30	19 17N	W63 30.8	10	ENE	E	28.1c	27aF	25 nm	4ev7
		Finish Haul:	19 13N	W63 08							

SWF	40	60	40	60	40	60	40	50	55	50	40/40/50	**625**
YFT	70											**70**
BET	35	30	20	30	30							**145**
WHM	65	35	25									**125**
MAHI	25											**25**
SHK												**0**
WAH												**0**
TOTAL												**990**

Source: Robert Lee, "Anguilla Offshore Fisheries Development Project: Report of Masterfisherman," April 1999.

Appendix B7.--Anguilla. Financial reconciliation of a fishing voyage

INCOME			
SPECIES	LBS	US/LB.	AMOUNT
YFT	451.00	3.00	1353.00
SWF	1696.00	4.00	6784.00
BET	165.00	2.60	429.00
MAR	987.00	1.00	987.00
MAHI	50.00	3.00	150.00
SHK		1.50	0.00
WAH		3.00	0.00
SNAPP		3.00	0.00
GROUP		2.50	0.00
TOTAL	3349.00		9703.00

EXPENSES			
ITEM	QTY	PRICE	AMOUNT
Fuel	440.00	0.97	426.80
Food	1.00	141.78	141.78
Oil	10.00	8.00	80.00
Gear Losses	20.00		16.22
L.Sticks	1601.00	0.36	576.36
Bait	960.00	1.30	1248.00
Ice			0.00
Salaries			0.00
TOTAL			2489.16

Gear Losses	Qty	Price	Amount
Hooks	6	0.80	4.80
Sinkers	6	0.70	4.20
Snaps	6	0.87	5.22
Buoys		10.00	0.00
Beeper		1200.00	0.00
Mono	8	0.25	2.00
TOTAL			16.22

CREW			
No:	Days	Rate	Amount
Captain	5	43.33	216.67
Mate	5	36.67	183.33
Engineer	5	33.33	166.67
Cook	5	26.67	133.33
TOTAL			700.00

CREW SHARE		
INCOME		9703.00
EXPENSES		2489.16
PROFIT		7213.84
Crew Share	30% Profit	2164.15
Boat Share	70% Profit	5049.69
Breakdown	Nr.Crew	
Captain	1	541.04
Mate	1	541.04
Engineer	1	541.04
Cook	1	541.04
Crew1	0	
Crew2	0	
Total Crew	4	

Source: Robert Lee, "Anguilla Offshore Fisheries Development Project: Report of Masterfisherman," April 1999.

Appendix B8.--Anguilla. Anguilla Offshore Fisheries Development Project, Fishing results, 1998-99

Voyage	Date	# sets	Hooks	Line met.	Catch Lbs	Income U$	Expenses	Profit	Boat	Crew
1	14/05/98	1	414	23400	385	1210	437	775	422	233
2	19/05/98	1	640	48600	520	1180	551	645	323	193
3	03/06/98	1	615	48600	645	2393	521	1872	1186	562
4	11/06/98	1	615	38000	901	2224	466	1758	1105	527
5	17/06/98	1	615	38000	265	1325	392	933	529	280
6	24/06/98	1	615	42300	265	362	350	12	-118	4
7	06/07/98	1	550	39000	209	1011	417	595	299	178
8	14/07/98	1	550	55000	255	621	482	140	-29	42
9	21/07/98	1	606	55000	246	105	548	-423	-442	-133
10	28/07/98	1	600	42500	0	0	596	-596	-545	-179
12	27/08/98	1	700	45000	532	760	519	241	51	72
13	01/09/98	2	1370	72000	1583	3564	1056	2508	1640	752
14	08/09/98	1	685	45000	354	608	550	59	-74	18
15	15/09/98	3	2150	113400	907	1868	1289	579	275	174
16	30/09/98	2	1248	92000	345	812	914	-102	-298	-31
17	07/10/98	2	1280	72000	653	2215	799	1416	764	425
19	27/10/98	2	1223	72000	100	324	1135.15	-530.75	-651.52	-159.22
20	04/11/98	2	1005	69000	1140	3659.6	1501	2578.37	1384.86	773.51
21	11/11/98	6	3820	236920	1761.25	6721.6	4288.52	3611.33	1349.68	1083.4
22	27/11/98	3	1897	100008	1926	5482	2973.35	2508.68	1056.08	752.6
23	11/12/98	4	2585	133344	1375	4104.3	2489.6	1614.7	484.41	290.29
24	06/01/99	2	1016	74340	676	2306.6	955.75	1350.85	665.6	405.26
25	16/01/99	4	2405	178718	1365	4514.6	2260.83	2253.7	737.64	676.13
26	27/01/99	4	2400	174828.8	2551	7700.8	2015.63	5685.17	3279.6	1705.55
27	10/02/99	3	1692	120009.6	561	1816.5	1554.6	261.9	-376.67	78.57
28	24/2/99	3	1876	123898.8	2583	8257.8	1643.01	6614.79	4070.36	1984.44
29	07/03/99	3	1936	133529.2	1522	5174	1677.88	3496.52	1887.56	1048.95
30	23/3/99	5	3471	225018	3189	10130	2623.72	7506.38	4254.46	2251.91
31	31/3/99	3	2019	143530	2115	5120.4	2373.62	2746.78	922.75	824.03
32	15/4/99	3	1790	128528.8	1384	3553	2801	427	-260.64	128.3
33	26/04/99	4	2369	172421.2	1724	5584.1	2291.38	3292.72	1604.91	987.82
34	06/05/99	3	1858	140752	1057	3543	2043.82	1499.38	489.56	449.81
35	21/5/99	2	1369	85562.4	1552	4316	1639.23	2676.77	1873.74	803.03
36	28/5/99	4	2802	181125.6	3349	9703	2489.16	7213.84	5049.69	2164.15
37	08/06/99	4	2685	180755.2	1555	4647.4	2840.8	1866	1264.62	541.98
TOTALS		**85**	**53471**	**3544090**	**39550.25**	**114102.2**	**51485.05**	**67086.13**	**34174.69**	**19907.51**

Source: Robert Lee, "Anguilla Offshore Fisheries Development Project: Report of Masterfisherman," April 1999.

Appendix C.--Anguilla. Composition of the Anguillian Offshore Fishery Development Project landings, 1998-99

Species	Proportion	Prices
	Percent	US$/kg
Swordfish	50	7.72*
Tunas		
Yellowfin	18	6.61*
Bigeye	9	NA
White marlin	16	2.20
Shark	6	3.31
Dorado	1	6.61

Note: This data does not included the sharks and other species which are discarded at sea.
* Loins: $12.13/kg.
Source: Robert Lee, Anguillian Offshore Fishery Development Project, personal communications, June 1, 1999.

Appendix D.--Anguilla. Foreign longline operations in ICCAT square 1560*, 1968-97

Country Square*	Year	Quarter 1	2	3	4	Total
		Metric tons				
Cuba		No fishing				
Japan	1961		0.1			0.1
	1962		0.9	0.2		1.1
	1963		0.8	0.3		1.1
	1964		2.3	0.1		2.4
	1965		0.8	0.2		1.0
	1966	0.4	8.6	3.7	1.2	13.9
	1967		0.2			0.2
	1968	0.3	0.4	0.8	0.1	1.6
	1970		0.1	0.1		0.2
	1971	1.3	0.2	2.2		3.7
	1974				2.7	2.7
Korea	1977		0.7		1.1	1.8
	1978		0.4	5.6	2.1	8.1
	1979	0.2	0.8	1.3	2.8	4.1
	1981			0.1	0.2	0.3
	1985		0.2	6.2	0.2	6.6
	1986	0.1	0.3			0.4
Spain		No fishing				
Taiwan	1968			3.6		3.6
	1969		0.2		0.6	0.8
	1970		0.5	0.2	1.4	2.1
	1971		1.2			1.2
	1972		0.2			0.2
	1974		1.0	0.2		1.2
	1975	3.1	1.5	0.4		5.0
	1977		2.5	1.8		4.3
	1978		0.5	0.5		1.0
	1979		6.3		1.2	7.5
	1980		2.4	0.2		2.6
	1981		1.3	0.1		1.4
	1982		5.4			5.4
	1983		1.0			1.0
	1984		0.1	0.4	0.5	1.0
	1985		0.8	0.2		1.0
	1986		0.6	0.2		0.8
	1987		1.1	0.1		1.2
	1995		**			
	1996			1.7	1.1	2.8
	1997	0.5	0.8			1.3
United States**		Data not available				

* 5 degree square. The lower right hand (southeast) corner is 15°N, 60° W.
** At the time this report was being prepared, ICCAT was revising the U.S. data. They had just completed a major revision of the Taiwan and Japanese data. The data reported here, is substantially different than that previously available through ICCAT and thus may disagree with previous reports using the older data.
Source: ICCAT: http://www.iccat/es/Stats.html, retrieved July 3, 2000.

Appendix E.--Anguilla. Swordfish exports by destination, 1991-99

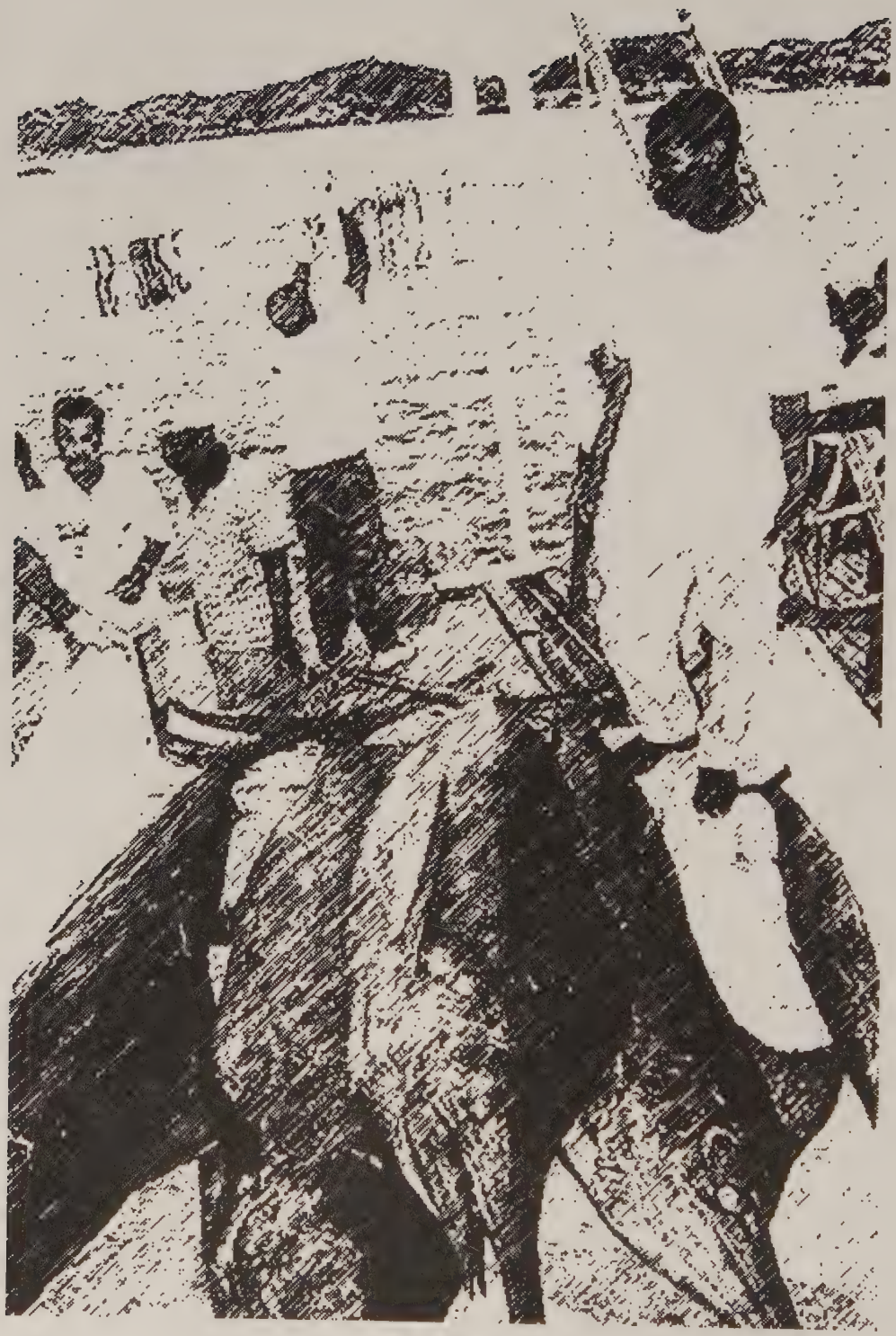
Destination	Year									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Metric ton									
United States	-	-	-	-	-	-	-	-	-	-
Japan	-	-	-	-	-	-	-	-	-	-
European Union	NA	-	-	-	-	-	-	-	-	-*
Others**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	NA	-	-	-	-	-	-	-	-	-

* Through November
** Swordfish shipments to other countries are believed to be non-existent or negligible.
Source: Various

Appendix F.--Anguilla. Seabird nesting, 1984

Area	Information	Species*	Known** threats	Importance***
Sombrero	Reasonable	5, 10, 14, 16, 18, 19, 22	None?	Extremely important
Anguilla#	Poor	5, 7?, 8, 10, 11	Ex?	Important?

\# And associated cays.
* Species: 5 - Phaethon aethereus; 7 - Fregata magnificens; 8 - Sula dactylatra; 10 - Sula leucogaster; 11 - Pelecanus occidentalis; 14 - S. sandvicensis acuflavida; 16 - S. dougallii; 18 -S. anaethetus; 19 - S. fuscata; 22 - A. stolidus
** Threats: Ex - exploitation of eggs, young or adults; Pr - predators, generally introduced mammals; Ha - habitat destruction or disturbances; Po - pollution; Fi - fisheries
*** A rough subjective rating of relative importance of area for breeding seabirds.
Source: Ruud van Halewyn and Robert L. Norton, "The status and conservation of seabirds in the Caribbean," in J.P. Croxall, P.G.H. Evans, and R.W. Schreiber (eds.), "Status and conservation of the world's seabirds," *ICBP Technical Publication*, No. 2 (ICBP: Cambridge, 1984), pp. 175-176.



2

ANTIGUA AND BARBUDA

Antigua and Barbuda have only a small artisanal fishing industry conducted on the reefs around the two islands and in the large shelf area between the major islands. Antiguan fishermen report declining yields during recent years. The FAO reports that catches may be as low as 500-600 metric tons. Unlike many islands in the Lesser Antilles, the Antigua and Barbuda catch is largely demersal, taken in the heavily fished relatively shallow areas around the islands and on the shelf. There is very little fishing for pelagic species, although the Government is promoting such fisheries to diversify the industry. Antiguan fishermen have attempted to initiate a commercial longline fishery for swordfish, tunas, and related species. Different groups have operated a few longliners and small export shipments have been reported to the United States. The longline operations, however, have met with only limited success. Some longlining was reported in the late 1980s and one company achieved some success in the mid-1990s with two longliners. That company was still operating one U.S.-built commercial longliners in 2000, but markets all of the catch domestically. No swordfish or tuna exports have been reported to the United States since 1995.

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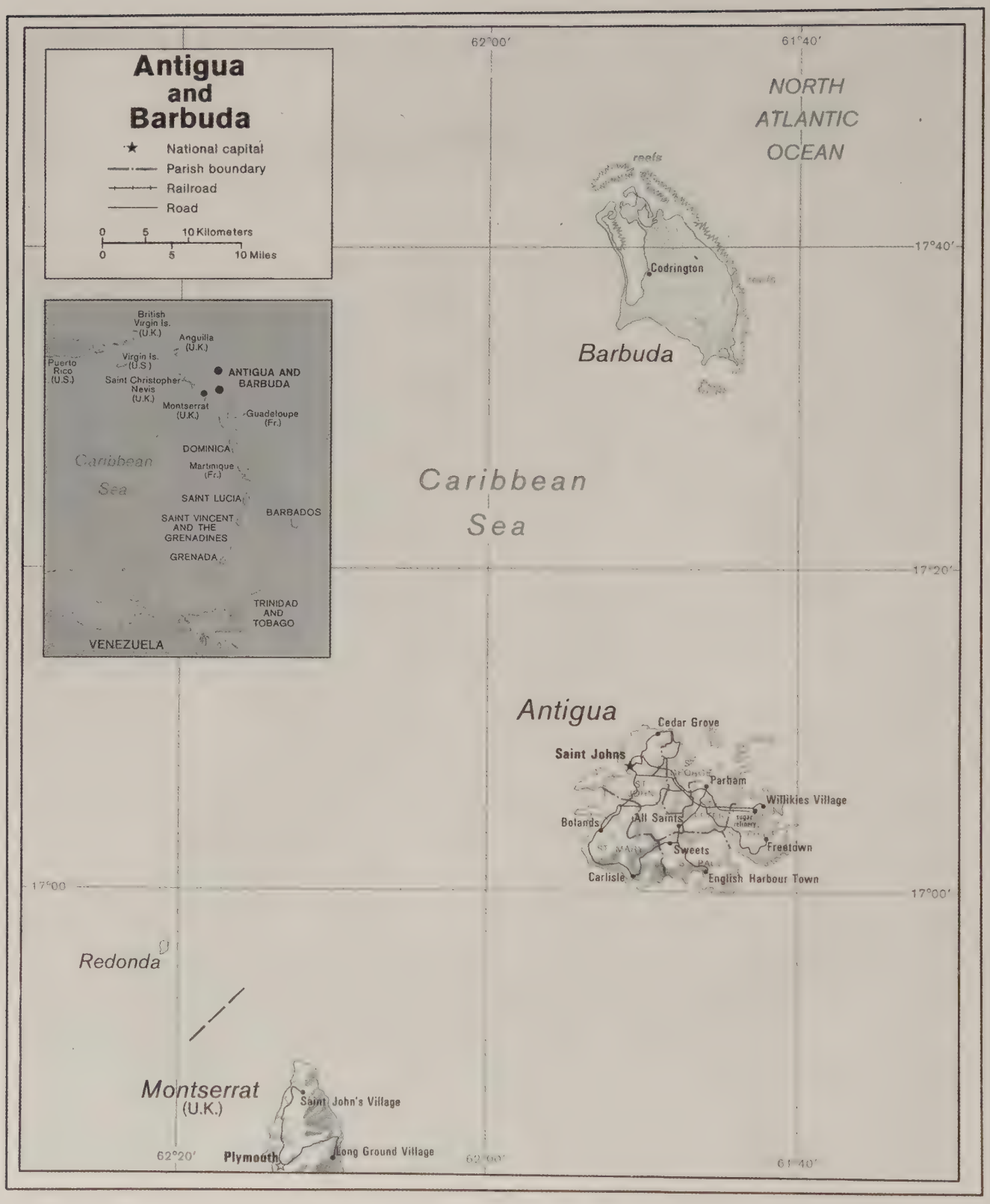

Figure 1.--Map of Antigua and Barbuda.

I. Overview

A. Background

Antigua was discovered by Columbus and named by him after a Seville church that he admired. It was colonized by English settlers in 1632 and the Antigua settlers colonized nearby Barbuda in 1661. Wind patterns, until sea-going vessels were converted to coal in the mid-19th century, made Antigua a key strategic Caribbean post and the British established an important naval base there. Antigua and Barbuda were linked in the British Leeward Islands Federation (1871-1956) when subsequently Antigua was made a separate Crown Colony and joined the short-lived West Indies Federation (1958-62). Antigua was made an Associated State of the United kingdom in 1967 and obtained full independence in 1981.

The Antigua government is a multi-party democracy, and the government since independence has been dominated by the Labour Party. The British monarch is still the head of state who appoints a Governor-General. Antigua has a bicameral Westminster-style parliament consisting of a House of Representatives and Senate. The Governor-General appoints a Prime Minister, and on the latter's advice, other members of the country's cabinet.[1]

The country is composed of three islands in the Lesser Antilles: Antigua (279 square km), Barbuda (160 square km) to the north, and Redonda (an uninhabited rocky islet, 1 square km) to the southwest. The islands are located in the northeastern part of the Lesser Antilles, about 250 miles southeast of Puerto Rico, east of St. Kitts and north of Guadeloupe.

B. Fishing industry

The Antigua and Barbuda fishing industry is largely artisanal. Some observers report that the country's artisanal fishermen are very traditional, many still using older gear and methods. Many fishermen continue to use small, open boats, about 3-8 meters (m) in length, powered by small outboard engines. These fishermen make short trips, usually less than 24 hours. Other fishermen operate sloops and launches, ranging from 9-15 m long, which are powered by small in-board diesel engines. These fishermen make longer trips, about 2-3 days, but usually did not fish at night. Only the longliners targeting swordfish have engaged in nighttime operations. Most fishermen operate around the islands or on the Antigua and Barbuda shelf which means they are rarely more than 25 km offshore.[2]

Fishery officials report that an increasing number of fishermen are using more modern equipment. They believe that the gear and methods employed by Antiguan fishermen should no longer be called traditional. The modern gear fishermen now use can in many cases can be deployed in a variety of fisheries. Officials report that an increasing number of fishermen are beginning to conduct operations at night.[3]

Antigua and Barbuda reports that there are 900 registered fishermen. About 20 percent are involved in full-time fishing. The remaining 80 percent fish on a part-time basis or are involved in recreational fishing. About 60 percent of the Antigua and Barbuda fishermen are based in St. John's on Antigua.[4] More than half have worked in fisheries for more than 10 years.[5]

The country's fishery is based almost entirely on the harvesting of demersal resources on the extensive reef area around the two main islands and on the country's continental shelf. The catch is almost

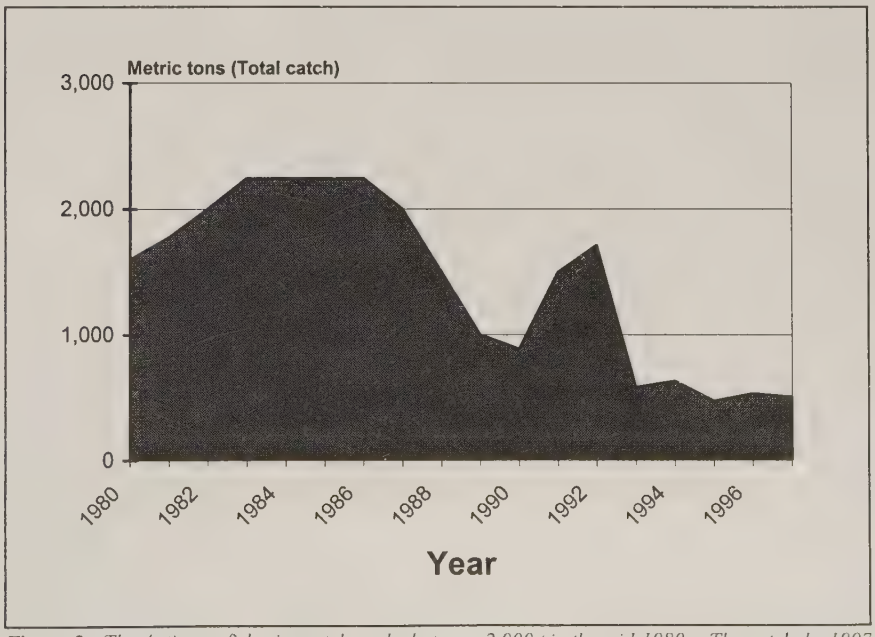

Figure 2.--The Antiguan fisheries catch peaked at over 2,000 t in the mid-1980s. The catch by 1997 has fallen about 75 percent to 500 tons

entirely demersal reef fish and lobster.[6] Fishery resources in the northeastern Caribbean from Puerto Rico to Antigua appear relatively limited.[7] This is in part because of the limited shelf area available to fishermen on other islands. Antigua and Barbuda are an exception because of the large shelf area and extensive coral reef structures located between and around the two principal islands. This provides Antigua and Barbuda fishermen access to a substantial population of demersal species.

Antiguan officials are not sure what gear fishermen are currently deploying to greatest success. Older reports suggest that much of the Antigua and Barbuda catch was harvested with wire fish traps. Some fishermen also deployed hand lines and artisanal bottom longlines. There was in the past virtually no artisanal effort directed at small pelagic species or offshore species such as tunas, kingfish, and dorado. Officials currently report that many Antiguan fishermen carry multiple gear and no data exists to accurately indicate which gear is now dominate in the fishery.[8] The substantial catch of demersal species in the 1980s[9] suggest, however, that traps and lines were the dominate gear. The fishermen do take some sharks with bottom longlines.[10] Current data by species is not available to assess gear trends.[11]

The Antiguan demersal fishery contrasts markedly with that of several East Caribbean islands where pelagic species dominate the local fishing industry. This is probably explained by the fact that most of the other islands do not have large shallow off-shore grounds where demersal species can be easily exploited with traps and lines. Many of the other islands have only a narrow shelf. As a result, fishermen on those islands have had to turn to more demanding, off shore pelagic fisheries.[12]

Published Antigua and Barbuda catch data is very limited and provides little insight on the species being taken. CARICOM estimates that in 1994 nearly 75 percent of the catch as demersal finfish. Most of the rest of the catch is conch and lobster (about 23 percent). Pelagic species accounted for a very small part of the catch (2-3 percent).[13] Antiguan officials, however, report that the CARICOM estimates are based on 1984 data and not 1994 data as indicated in the CARICOM website. Officials report that no current data has been calculated to provide details on the species currently taken by Antiguan and Barbudian fishermen.[14]

While detailed Antigua and Barbuda catch data is not available, some estimates have been published by FAO. The FAO catch estimates suggest the fishery peaked in 1984-86 at about 2,200 metric tons (t) and has since declined. The catch fell below 1,000 t in 1993 and has since ranged from 470-630 t (appendix B1). FAO estimates that the 1997 catch was about 500 tons. Antiguan fishery officials report that actual catches in recent years have not fallen although yields have definitely declined.[15]

FAO estimates suggest that Antigua's fisheries catch was composed of various marine fish (380 t), conch (65 t) and lobster (55 t). The country has an adverse balance of trade in fishery products, importing $2.4 million and exporting only $0.9 million (Caribbean Overview, appendices F1a-b).

II. Species

The authors know of no published studies describing swordfish behavior specifically off Antigua.

A. Spawning

The spawning grounds for swordfish are primarily deduced by the location and abundance of swordfish larvae. One 1983 study reported that there is relatively little spawning within the Caribbean itself, although some limited spawning does take place south of Cuba.

Considerable spawning activity is reported off western Cuba in the Gulf of Mexico, but especially in the Yucatan and Florida straights, but there is also some spawning around the Lesser Antilles--primarily from north of Anguilla to St. Lucia.[16] Researchers have identified the area northeast of the Lesser Antilles where mature fish are present and spawning may be occurring.[17]

The swordfish larvae found around the Lesser Antilles are both small and large sized. The lesser numbers of small larvae suggest that spawning is less intense than in the western Caribbean off Cuba, however, this may at least in part be a function of the more intense larval collection work in the western Caribbean, especially in or near U.S. waters. The numbers of large larvae found around the Lesser Antilles suggest that larvae spawned locally are retained there or recruited from adjacent regions.[18] A more recent analysis shows a similar pattern of larval concentrations in the Gulf of Mexico and U.S. southeastern coast, but some more limited

concentrations in the northern Lesser Antilles.[19]

B. Migration

The best evidence on swordfish movements comes from tagging. Tagging swordfish, however, has proved to be a difficult proposition. One of the biggest problems is the small number of fish taken by the catch and release recreational fishery. The limited number of tag returns suggest a movement of swordfish from the Caribbean area to and from the northwest Atlantic. Available tag returns show that several swordfish have been tagged off New England and the Grand Banks and retrieved in the northeast Caribbean (Caribbean Overview, appendix C3). Many fish especially large females, appear to be feeding during the summer in the rich waters off New England and Canada and then returning to the Wider-Caribbean to spawn. The tag returns from the northeastern Caribbean are discussed in more detail in the Anguillian chapter of this report and the overall migratory pattern of Caribbean swordfish discussed in the Caribbean Overview.

III. Grounds

A. Oceanography

Antigua is the largest of the British Leeward Islands. Antigua and Barbuda are located in the middle of the Leeward Islands in the Eastern Caribbean, about 17°N of the equator. The islands of Montserrat and Guadeloupe are located to the south, Nevis, St. Kitts, St. Barts, and St. Martin are located to the north and west. Antigua and Barbuda also includes the small uninhabited island of Redonda which has been made a nature preserve.

Antigua and Barbuda experience the steady Trade Winds. They are nearly constant, usually abating only in September. There is a complex coastline of safe harbors, and a protective, nearly unbroken coral reef. Antigua is now best known as a tourist destination, but in the 18th and early 19th centuries in the days of sailing ships, the islands location astride the Trade Winds and protective harbors made it a strategic location in a very important part of the world. The immense value of sugar in the economies of the 17th and 18th century made Caribbean possessions some of the most important to the European colonies. Famed British admiral, Horatio Lord Nelson established a naval base on Antigua in 1784. Barbuda on the other hand was best known for salvaging because so many ships were wrecked on its coral reefs.

While the Trade Winds are usually benign, hurricanes can devastate Caribbean islands--especially low lying islands like Antigua. Hurricane Luis in September 1995 tore through the eastern Caribbean, inflicting especially severe destruction upon Antigua and Barbuda. Luis damaged or destroyed more than 75 percent of the island nation's buildings, causing an estimated $0.3 billion in property damage--devastating to a small country like Antigua. The Antiguan government declared a national emergency and asked the United Nations for assistance. United Nations Development Program officials report that the country's economic development was set back by at least 10 years.

B. Topography

The two principal islands of Antigua and Barbuda share a common shelf. The shelf is larger than that of many other larger Caribbean islands. Antigua is much larger than Barbuda and most of the country's population and fishermen live on Antigua. Barbuda is a flat coral island rising 44 meters (m) above sea level. The two islands are located at the southerly and northerly extremes of that shelf--Antigua is located on the south of the shelf and Barbuda to the north. Most of the shelf is thus located between the islands. Only a very narrow shelf is found south and east of Antigua and north and east of Barbuda.

Both Antigua and Barbuda face the open Atlantic and thus have an extensive 200-mile Exclusive Economic Zone (EEZ) projection northeast and east. The EEZ is, however, very limited to the west because of St. Kitts and Nevis and to the south because of Montserrat and Guadeloupe. The full extent of the Antigua and Barbuda EEZ is not known because negotiations with neighboring states to delimit the marine boundary have not yet been completed. Antigua and Guadeloupe are separated by one of the many Caribbean passages, the Guadeloupe Passage.

The small uninhabited, rocky islet of Redonda is located to the west of Antigua. Redonda is completely separated from the Antigua and Barbuda shelf and is located on its own small shelf between Nevis and Montserrat.

C. Fishing grounds

Antiguan artisanal fishermen do not target swordfish and other large oceanic pelagics. The country's fishery focuses on demersal reef resources on inshore grounds.[20] The large expanse of shelf area between the two main islands provides the principal fishing ground for the artisanal fishermen.

Antiguan fishermen have attempted commercial longlining. Three Antiguans have conducted swordfish operations out of Antigua in recent years. One Antiguan fisherman, Lucian Barreto, has reported offshore longlining operations since 1988. Barreto fishes mostly in the Atlantic off the eastern coast of Antigua and Barbuda and rarely in the Caribbean off the western coast. (See: "Companies.") Barreto reports primarily deploying his longliners in the Atlantic, usually about 65-100 km off the eastern coast of Antigua and Barbuda.[21] He has occasionally ventured further from Antigua as one of his vessels (the *Sea Hawk*) obtained a Grenadian fishing license in 1988 (Grenada, appendix D). Information on the grounds targeted by the other Antigua longliners is unavailable.

Foreign fishermen have also operated off Antigua. Antiguan sources indicate that U.S. longliners operating in the area are usually deployed further east in the Atlantic and in the Caribbean south of Montserrat to St. Vincent and as far west in the Caribbean as the Venezuelan Aves (Bird) Island or beyond.[22] Foreign fleet operations in the northeastern Caribbean are discussed in more detail in the Anguillian chapter of this report and the Caribbean Overview.

IV. Fleet

Antiguan officials report that they do not maintain data on the types of vessels deployed in the fishery. Much of Antigua's largely artisanal fleet was employed to set and harvest fish traps ("pots"). Most of the lobster catch is taken with traps. Officials now report that fishermen carry a variety of gear on their boats. CARICOM reports that are three seine fishermen and approximately 25 gill-netters. A significant fishery exists for conch which are taken by divers with SCUBA gear.[23] Antiguan officials, however, are skeptical about the accuracy of the CARICOM estimates which they claim are often based on dated information. Antiguan officials do not maintain data on the fishing fleet by vessel type, but report that the CARICOM estimates are not accurate.[24] A few, mainly sport fishing boats, are known to fish by lines (trolling). A few longliners reportedly operated out of Antigua in 1998 (appendix A), but the authors have no information on the extent, if any, of such operations in 1999 and 2000. The Government reports an increasing interest in expanding longline operations, but there is little evidence of any major efforts to expand the longline fleet.

A. Artisanal vessels

There appears to be some difference of opinion among Antiguan and Barbudian observers about the size of the island's artisanal fishing fleet. CARICOM data suggests that over 200 small artisanal fishing boats were active in Antigua and Barbuda. One now dated report indicated that Antiguan artisanal fishermen operated about 250 small boats, suited for inshore trap fishing. A more recent report indicated that there were about 450 small boats. Fishery officials in 2000 reported 550 small boats had been registered. Out of that total 150-300 boats have been licensed to fish.[25] This roughly equals the CARICOM estimate of 235 boats.[26]

Most of the Antigua and Barbuda artisanal fishing boats are about 9 meters (m) long, although there are a few larger vessels of up to about 17 meters. One 1979 report suggested that the traditional boats used by the Antiguan fishermen were somewhat larger than those commonly used on many other Caribbean islands.[27] The island's artisanal fishermen use several different types of boats. The most common is the simple open dory. Sturdily built dories were once the traditional craft used by Antigua and Barbuda artisanal fishermen. They were open boats, about 3-8 meters (m) in length, powered by small outboard engines. CARICOM as recently as 1999 reported that they constituted half of the fleet of 236 boats.[28] FD officials report, however, that Antiguan fishermen no longer call their boats dories. They currently classify their boats as pirogues with or without cabins.[29]

CARICOM estimates that there are about 235 active fishing boats. The FD reports that they have licensed 150-300 boats. Information on each type of vessel is limited. The authors provide the following data from CARICOM. The FD does not believe that this data is an accurate description of the fleet, but had no current data to show the current state of the fleet.[30]
Dories: CARICOM reports that about half of the Antiguan artisanal fleet, or about 110 boats was composed of dories.[31] FD officials report that this

term is no longer used to describe Antiguan fishing vessels.[32]

Open cabin: CARICOM estimates about 40 open cabin boats were active in 1999.

Lunches: Launches are one of the larger vessel types used by the local fishermen, ranging from 9-15 m in length. About 20 were active in 1999. They may make trips up to 3 days. Launches are powered by small in-board diesel engines.

Sloops: Sloops are another of the larger vessel types used by the local fishermen, ranging from 9-15 m in length. About 30 were active in 1999. They may make trips up to 3 days.

Sport boats: About 25-30 sport fishing boats are active on Antigua.[33]

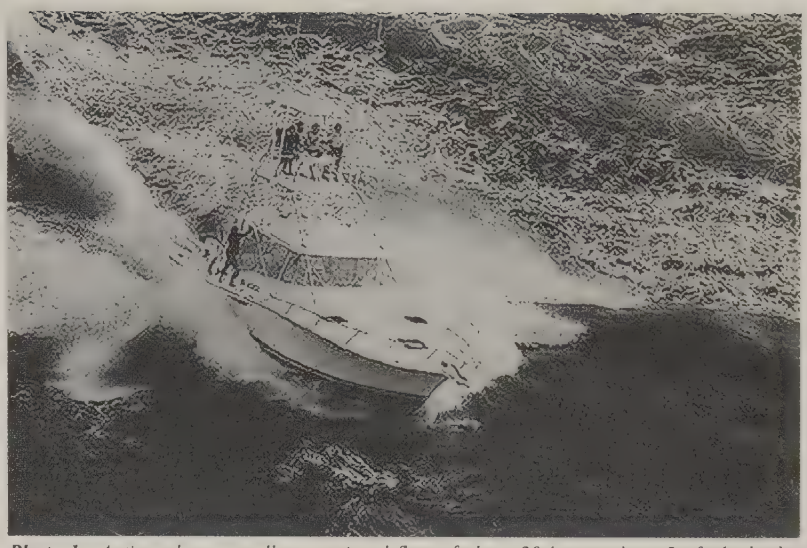

Photo 1.--Antigua has a small recreational fleet of about 30 boats, about 5 of which also are involved with commercial fishing. ABSFA

B. Commercial vessels

The principal commercial fishery attempted by Antiguan fishermen has been longlining. Antiguan fishermen have operated several longliners since the late 1980s (appendix A). The first report of Antiguan longlining was noted by the authors in 1988.[34] The website maintained by CARICOM for Antigua reports that two longliners were active in 1999, but FD officials report that no longliners are currently active on the island.[35] The authors can find no indication that two longliners are active. Perhaps the CARICOM report is old information that needs to be updated or refers to longliners that are currently being deployed in other fisheries. FD officials informed the authors that in 1999 there were no commercial longliners.[36]

Caribbean Seafood: Lucian Barreto operated the 11.6 m *Sea Hawk* during 1988 and 1989, but sold it in 1990 when he purchased two larger longliners. The two new longliners (the *Silver Star*, and the *Stanley B*) both are 15.5 m (Broadfire) longliners imported from the United States.[37] Barreto formed Caribbean Seafood in 1992 which began operating the *Silver Star* and *Stanley B* until 1996 when they were sold. The FD confirms that neither the *Silver Star* or the *Stanley B* have operated on the island since 1996.[38] U.S. import data show swordfish and tuna imports from Antigua during 1993-95 (appendix D2a1). Unconfirmed reports suggest that the swordfish longline operations of Caribbean Seafood did not achieve catch rates high enough for profitable operations. Company officials complained of competition with foreign longliners. The company does currently operate the 12-m *Ocean Venture* which it described as a small longliner.[39] A local observer, however, indicates it is more suitable for trolling and sport fishing than longlining.[40]

Others: Two other Antiguans have operated longliners. The 18.3 m *Joe Pri* was active in 1988, but subsequently sold to a Guyanese company and converted for shrimp trawling. The 11.6 m *Jenny B* was also active in 1988, but was apparently retired in 1990. Both owners reportedly ceased longlining because of disappointing results.

C. Recreational vessels

Tourism is a vital part of the Antiguan economy, but sports fishing does not appear to be a major attraction.[41] A 1988 report indicated that a fleet of about 25 sport boats landed about 20 blue marlins annually.[42] The recreational fishery appears to have changed little in recent years. A 1995 reports indicates that Antigua had about 30 sports fishing vessels targeting billfish. About 6 of these vessels operate commercially, landing the catch and marketing it domestically. Some charter boats are available. Paradise Boat Sales located at Jolly Harbour is a company through which tourists often access charter boats.

V. Shipyards

The small boats used by the local fishermen have traditionally been mostly built in St. Johns' by carpenters. In recent years, artisanal fishermen have been turning to fiberglass pirogues, a pattern being repeated throughout the Caribbean. A Trinidadian company, Spra-gls, sells pirouges to Antiguan fishermen. The boats are usually delivered to Killing Point, a popular landing site for the fishermen.[43] The authors had received unconfirmed reports that a Trinidad company was manufacturing fiberglass pirogues on Antigua. Fishery officials report, however, that the company delivers pirogues built in Trinidad, but does not build them on Antigua.[44] Commercial fishing vessels are imported, generally from the United States.

VI. Fleet Operations and Gear

The Antiguan fishing industry is primarily artisanal, but one company has conducted commercial operations, including longline fishing for swordfish and other oceanic pelagics.

A. Artisanal fleet

Antigua has about 900 artisanal fishermen, according to a 1999 Fisheries Division registry, but only a small number fish full-time.[45] The fishermen do not deploy offshore longlines and thus rarely catch swordfish. The artisanal fishermen deploy a variety of gear, including gillnetting, trolling, beach seining, handlining, longlining with snapper reels, spear fishing, and trapping. Most of the catch is harvested by the traps.[46] The extensive use of traps set on reefs virtually precludes incidental swordfish catches.

B. Commercial fleet

One Antiguan company, Caribbean Seafood, has conducted commercial fisheries, including longlining for swordfish and oceanic pelagics.[47] (See: "Companies.") Fishermen using U.S. methods reported catch rates per trip of 0.9-2.3 t of swordfish and 0.5-1.4 t of tuna. These results were about what comparable medium-sized U.S. longliners report in Caribbean operations.[48]

C. Recreational fleet

The Antigua and Barbuda Sport Fishing Association (ABSFA) sponsors an annual billfish tournament. The sport fishermen are presently required to tag and release fish under 300 pounds (90.7 kg). Recreational fishermen caught 12 fish over 200 lb in 1995 which were sold to Antigua's major fishing company, Caribbean Seafood. The wahoo taken by these vessels is also marketed domestically. One observer has noted declining domestic wahoo catches which he attributes to increased wahoo bycatches by the Taiwan fishermen targeting albacore. Albacore and wahoo both like silver bait, while squid is preferred by billfish. Marlin catches have reportedly improved a little since the United States implemented stricter billfish regulations.[49]

The Antigua and Barbuda Sports Fishing Club holds the Antigua and Barbuda Sports Fishing Tournament during May or June. It is sanctioned by

Photo 2.--Wahoo are one of the species most commonly taken by recreational fishermen in Antigua ABSFA

the International Game Fish Association. Sponsors maintain that it is the third largest and third oldest Caribbean billfish tournament. It is usually held along with the Whitsuntide holiday and normally attracts about 60 boats and 300-400 anglers. Participants are usually from the neighboring islands of Antigua, Dominica, Guadeloupe, Montserrat, St. Bart's, St. Kitts, St. Martin, and the U.S. Virgin Islands. A few participants from the southern Lesser Antilles also often participate.[50] The tournament focuses on blue marlin, but other species targeted are tunas, dorado, wahoo, and king mackerel. Swordfish, even juveniles, are rarely reported.

Reports on the annual tournament provide the following information:
1994: More than 55 boats participated in the 28th annual tournament held May 20-21, 1994. About 130 fish weighing 3.0 t were caught (appendix C). The fishermen caught 10 marlins under 90 kg which were tagged and released with the assistance of the FD.[51]
1999: The 33rd tournament was held May 22-23, 1999, with 55 boats and 271 anglers participating. The number of boats is limited by the size of the marina which can accommodate only 50-70 boats. Boats as large as 18 m participated and the average is about 10 meters. Fees were $70 per person and prizes total $50,000. Swordfish are not normally taken in the tournament which focuses primarily on blue marlin. The 2-day tournament is conducted 1-25 miles (40 km), primarily off the eastern coast on two offshore banks (South and North Bank). The 100 fathom line (183 m) balloons out in this area, which the tournament organizers believe create excellent conditions for the blue marlin. It is run from 6:30 am-4:00 pm on saturday and 5:00 an-2:00 pm on sunday. The tournament rules set a minimum blue marlin size of 300 lb (136 kg) live weight or 98 in (250 cm). The fishermen use 50 lb (22.7 kg) monofilament test line. The boats are required to move at 7-10 miles per hour and use artificial lures (plugs). Most of the participants were from Antigua, but several boats from Guadeloupe and St. Maarten also participate as well as a smaller number from other islands.[52] The largest marlin caught was 195 kg fish taken aboard the *Arawak*, a French boat registered in St. Martin. The second and third prize fish was 181 kg and 160 kg, respectively. The champion boat was another French boat, *Spirit of St. Barts* from St Barts, which took two

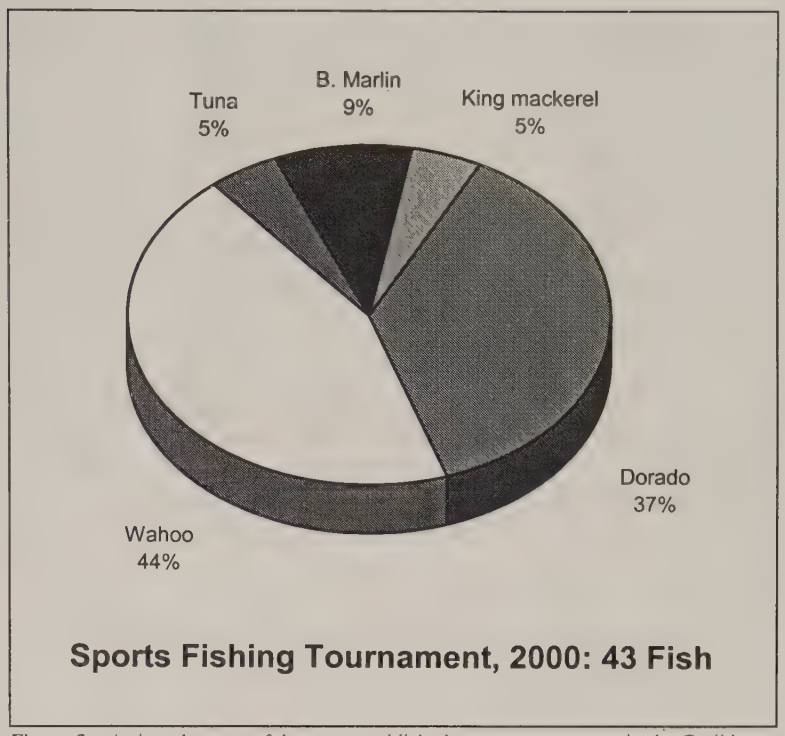

Figure 3.--Antigua has one of the most established sports tournaments in the Caribbean. Most of the catch in 2000 was wahoo and dorado.

***Photo 3.**--Blue marlin are the also taken by recreational fishermen in Antigua. These were landed at the 2000 tournament. ABSFA*

marlins. In the tag and release competition there was a tie between two boats, *Spirit of St. Barts* and *Orca* from Guadeloupe. Many of the billfish are tagged and released. Other fish taken included two white marlins as well as dorado, tunas, wahoo, and kingfish. One of the white marlins brought the 1998 record of 36 kilograms. The fish landed become the property of the tournament committee. They are sold to hotels, supermarkets, and retailers. One of the major outlets is Caribbean Seafood.[53]

2000: The 34th annual tournament took place on June 10-11. Organizers report that 41 boats with 223 anglers participated. Participants included: Antigua (25 boats), Dominica (1), Guadeloupe (9), Nevis (2), St. Barts (1), St. Martin (2), U.S. Virgin Islands--St. Thomas (1). The championship boat for the tournament was the *Orca* out of Guadeloupe. The tag and release prize was awarded to the *Overdraft* (Antigua) for releasing 140 kg of marlin. The anglers reported taking: blue marlin (4), dorado (16), king mackerel (2), tuna (2), and wahoo (19). The largest blue marlin was 144 kilograms. Most of the marlins were released, but the anglers are allowed to boat marlins over 300 lb (136 kg) if they wanted a trophy to be mounted. A special recognition was awarded to an angler whose large marlin was mutilated by the boat propellers. This year's catch was sold to Caribbean Seafood and Antigua Fisheries.[54]

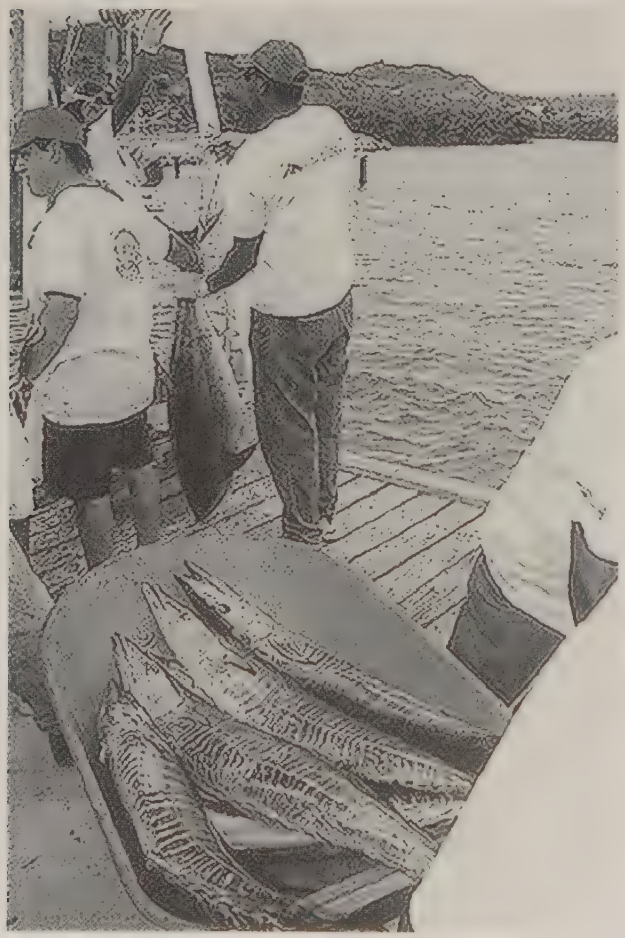

***Photo 4**.--Much of the fish taken in the recreational fishery and tournaments is subsequently sold on the local market. ABSFA*

2001: The 35th annual tournament will take place on June 1-4. The organizers are planning a 2-day fishing tournament with some changes. The anglers will be divided in two groups. One group will target only billfish and the other group will be in categories targeting dorado, kingfish, and wahoo.[55]

The Antigua and Barbuda Sportfishing Club also organizes other tournaments during the year. The Club reports a "Fun" tournament every November when Antiguans fish in route to Barbuda and Barbudians fish locally. The fishing culminates in a "cookup" held at the Spanish Point beach on Barbuda. Other smaller events are held as occasions to raise funds for charities.[56]

The recreational fishermen are highly critical of foreign fishing operations off Antigua. The Taiwan longline operation out of St. Maarten is the subject of considerable criticism. This is in part because they are the large foreign boats most often seen by the recreational fishermen. The Taiwan operation has been has been underway since the 1970s and Antiguan sport fishermen believe that it has adversely affected billfish stocks.[57] Taiwan fishermen do not target billfish, but large quantities are taken as a bycatch and landed at St. Martin. Most of it is then marketed on various Caribbean islands.[58] Sport fishermen are also critical of the new Japanese fisheries complex, Antiguan Fisheries, which they see as an, none to transparent, effort to virtually buy the Antiguan vote at the International Whaling Commission (IWC).[59]

The ABSFA has reported some difficulty with tournament participants who attempt to cheat. Some "unscrupulous" individuals use heavier testlines, bring in previously caught fish, or fish that weigh below the minimum requirements. Surprisingly, the owner of a large local fishing company was banned in 1997 for 10 years from ABSFA tournaments. Organizers intend to enforce the tournament rules by adding more strict financial sanctions to existing penalties.[60]

VII. Catch

The authors have been unable to obtain official Antiguan catch data. It is unclear as to when Antigua last published fisheries catch data. Antigua does not report catch data to FAO broken down by species.

The authors have no official Antigua swordfish catch data. The only company taking appreciable quantities of swordfish has been Caribbean Seafood. Fishery officials report that Caribbean Seafood is a private company and they do not have the legal authority to demand that the company provide catch or other data.[61] ICCAT has no entries for Antigua. Industry reports, however, indicate that some swordfish has been landed in Antigua since the late-1980s and that catches may have been as much as 30-50 tons. This is confirmed by U.S. import data (appendix). The last reported swordfish imports, however, were in 1995. Catches in most years, however, are believed to have been below that level.

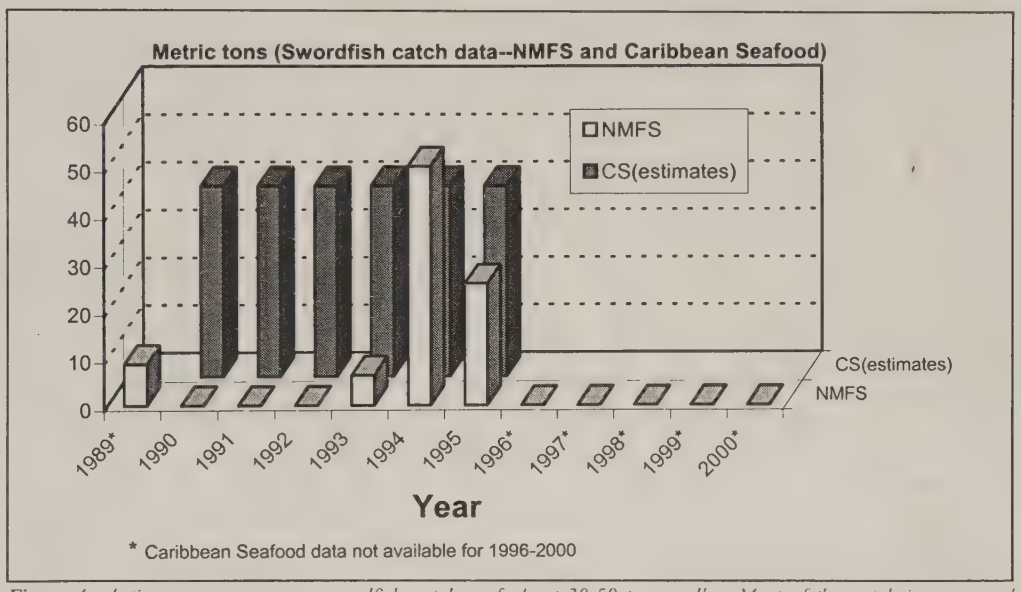

Figure 4.--Antigua sources report swordfish catches of about 30-50 t annually. Most of the catch is consumed domestically, but there have been occasional exports.

Available information providing indication of possible catch trends.

1988: A 1988 report indicated that one longliner was landing about 1.5 t monthly, mostly swordfish.[62] This would mean about 10 t of swordfish annually. Information on the other two active longliners is unavailable (appendix A).

1989: Swordfish catches continued in 1989. Catch data is unavailable, but shipments to the United States in 1989 confirm fishing activity and catches of nearly 9 t liveweight (appendix B2).

1990: Two of the three fishermen operating longliners withdrew from the fishery in 1989 or 1990 (appendix A). The third fisherman (Lucian Barreto) reported more successful operations and expanded his fleet in 1990, replacing his longliner with two larger longliners (appendix A). Swordfish catches since those two larger vessels were introduced averaged 30-50 tons.[63] U.S. imports, however, do not confirm any catches from 1990-92 (appendix D2a1). Catches could have been exported to other countries or more likely sold locally.

1993: Antiguan companies resumed swordfish shipments to the United States. Imports confirm that at least 6 t of swordfish (liveweight) were taken in 1993 (appendix B2). Actual catches were presumably higher as at least some of the catch must have been marketed locally.

1994: U.S. imports suggest that at least 50 t of swordfish (liveweight) may have been caught in 1994 (appendix B2).

1995: Caribbean Seafood (owned by Lucian Barreto) reported swordfish catches of about 50 t in 1995. U.S. imports accounted for about 25 t, the remainder could have been non-export grade fish or fish marketed locally, especially in tourist hotels. Yellowfin and other tunas were also taken by the longline fishermen and exported to the United States. There is also a billfish catch (mostly marlin) reported by the Caribbean Seafood longliners and the recreational fishermen.[64] Billfish catches probably totalled less than 10 t (Caribbean Overview, appendix G3).

1996: The authors have no current information on Antiguan catches. Notably export shipments of tuna and swordfish to the United States ceased after 1995 (appendix D2a1). This does not necessarily mean the fishery has ceased because exports could have been shifted to other countries or consumed locally. Apparently Caribbean Seafoods continued operating its two longliners, but marketed the catch domestically.

1997-98: No U.S. swordfish or tuna shipments were

reported by the United States during this period (appendices D2a1 and D3). Caribbean Seafood sold its two longliners, but bought a smaller fishing vessel.[65] (See "Companies").

1999: A CARICOM website indicated that Antigua had longliners in 1999, but FD officials report that there were no active longliners on Antigua in 1999.[66] There were no swordfish or tuna shipments to the United States (appendices D2a1 and D3). Caribbean Seafood reports, however, operating one vessel which they call longliner and marketing the catch locally.[67] (See "Companies").

2000: No swordfish or tuna shipments were reported to the United States during the first half of 2000 (appendix D2a1 and D3). Caribbean Seafoods reports continuing operations of its single vessel.[68] FD officials indicate, however, that they have not received any reports of longlining catch from Caribbean Seafood in 2000.[69]

VIII. Ports

The country's chief port is St. John's, the capital, located on Antigua. St. John's is built around a natural deepwater harbor. CARICOM reports, however, that St. John's Harbour is gradually "infilling" and requires constant dredging.[70]

Much of the country's fishermen operate out of St. John's. Most of the domestic fisheries catch is landed at St. John's, usually as much as 75 percent of the catch. The main location used to be the west bus station close to the market.[71] Currently fishermen deliver their catch to Antigua Fisheries Ltd. in St. Johns. Fishermen are no longer permitted to set up stalls at sites near the market.[72] The Antiguan longliners are believed to have primarily operated out of St. John's.

Fishermen also land their catch at numerous beach sites around the island. Much of these landings are sold locally. Often the catch outside of St. John's is landed on beaches or protected lagoon areas, but a few locations have jetties. Fishery officials report that there are 10-20 landing sites, but no data is available in their relative importance.[73]

The principal marina for the recreational fleet is at the Catamaran in Falmouth Harbour. The main settlement on Barbuda is Codrington.

IX. Transshipments

The authors know of no swordfish currently being transhipped through Antigua. The Government did allow a U.S. company, Merrit Seafoods, to establish a local operation in the 1980s. Merrit was one of the pioneers of the U.S. commercial longline fishery and Caribbean longlining operations. Antiguan officials were considering authorizing local fishermen to land their catch in Guadeloupe and Martinique if they would land at least part of it in domestic ports.[74]

X. Processing and Products

There is little processing of seafood on Antigua. Much of the catch is sold fresh by the families of the fishermen or crew members. There are also merchants who buy from the fishermen. The most important

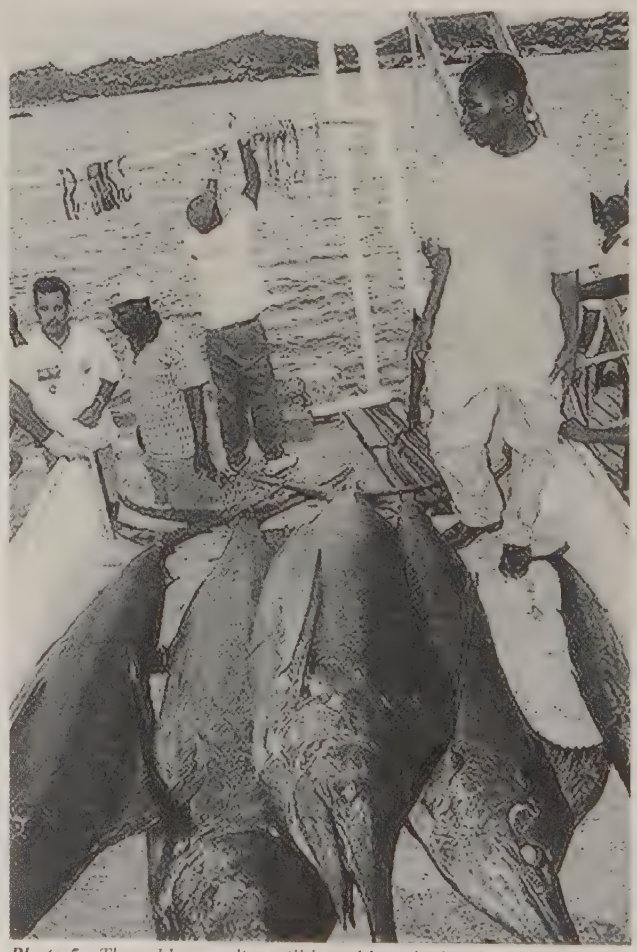

Photo 5.--These blue marlins will be sold on the local market, primarily to tourist hotels and restaurants. Caribbean Seafoods processes them to their customers specifications. ABSFA

retailer is Antigua Fisheries Ltd. located at the market wharf. Antigua Fisheries is the main supplier of flaked ice and together with Whites Fish Market at the Point Wharf provide the principal cold storage facilities on the island. Fishery officials report that a number of private individuals also produce ice and operate small cold stores.[75]

Caribbean Seafood processes swordfish fish in its St. John plant. The company reported producing fillets and steaks as well as handling whole dressed fish.[76] (See: "Companies.") This may well have been some of the product imported by the United States in 1993-95 (appendix D2a1), but the U.S. Census Bureau did not begin to break down swordfish shipments by product form until 1997.

XI. Companies

There are few seafood companies of any appreciable size on Antigua. None of these companies handle significant quantities of swordfish. The two most important seafood companies on the islands are Antigua Fisheries and Caribbean Fisheries.

Antigua Fisheries Ltd.: Antigua Fisheries Ltd. (AFL) is a state-owned company established in 1982 as a marketing agent to provide a reliable buyer for the country's small-scale local fishermen. The company is located in St. John's. AFL in the mid-1980s was reporting increasing losses--a common phenomenon reported by many other state fishing companies in Latin America. Government officials were considering possible privatization.[77] The company is the sole supplier of fishing equipment (spools, hooks, line, longlines, trap wire, green light sticks, hooks, buoys, and other gear).[78] AFL also purchases the catch of several local fishermen who they contract on a long-term basis. One of the vessels involved is a longliner, but was reportedly being used primarily in trap fisheries.[79] The local fishermen supply small quantities of snapper and other demersal fish (hinds, grunts, parrotfish, angelfish, butterfish, triggerfish, blue tang, squirelfish, and a variety of other species) which the company calls "mixed fish".[80] The fishermen in 1999 received about EC$5 per lb (US$0.80/kg) for the mixed fish. The local catch, however, is very limited and has to be supplemented with much larger quantities of imports. Antigua Fisheries handles about 3 t of fish weekly, and about 80 percent of that is the imported product. Most of the imports are obtained from Seafood Enterprises in Trinidad, primarily fresh red snapper and fresh or frozen kingfish, wahoo, and dorado. The company has cold stores and freezing lines, but most of the fish is processed as fresh product. The processed product is marketed locally. There are no exports. Sales are highly seasonal because of the increased demand during the peak tourist season (November through February).[81] The fishermen occasionally catch small quantities of marlin and swordfish which AFL then sells locally to hotels and restaurants.[82] The Government has sold a share of the company to several private Antiguan investors. The Japanese donated $15 million to the Antiguan Government for a new fisheries complex at St. Johns.[83] Current operating expenses total about $18,000 monthly. Antigua Fisheries planned to move into the new complex by October 1999. The company plans to expand the work force of 10 employees. The new manager, Mavis George, during 1999 received extensive training in Japan.[84] The company reported in May 2000 that the new facility was in full operation. Antigua Fisheries reports that the new plant and market provide excellent facilities for the fishermen. The company has, however, underestimated the staff needed which has meant that shipments have been delivered late. The company hopes to hire more employees, but additional Government financial support is needed.[85]

Caribbean Seafood: Caribbean Seafood is an Antiguan company based in St. John's. It is the largest Antiguan fishing company and is involved in the fishing, processing, and exporting of seafood. The company has had three vessels, two of which were 15.5 m (Broadfire) longliners used to target swordfish. Caribbean Seafood is the only Antiguan company which has handled oceanic pelagics. The company operated two longliners (the *Silver Star* and the *Stanley B*). The company owned the *Stanley B* outright and a half interest in the *Silver Star*. It currently operates the small multi-purpose vessel *Ocean Venture*.

1993-95: Caribbean Seafood employed American-style longlines that were about 50-55 km long and had 400-500 hooks. The Caribbean Seafood longline operations tended to concentrate about 65-100 km off the eastern (Atlantic) coast. The fishing trips took approximately 14 days and consisted of about 10 sets. The longliners caught about 50 tons of swordfish. The company has noted a decreased swordfish catch in recent years. The company also reported that their longliners took tunas (yellowfin and bigeye), blue marlin, and sharks (mainly blues but mako, thresher, and hammerheads also were taken). Incidental catches of rays and turtles were also reported. The swordfish and marlin are headed and gutted and the tails cut off on board. The tuna and wahoo were gutted and their tails are cut off. Caribbean Seafood believed that deheading these fish at the processing plant rather than at sea improved the quality of the meat around the spine area. The sharks

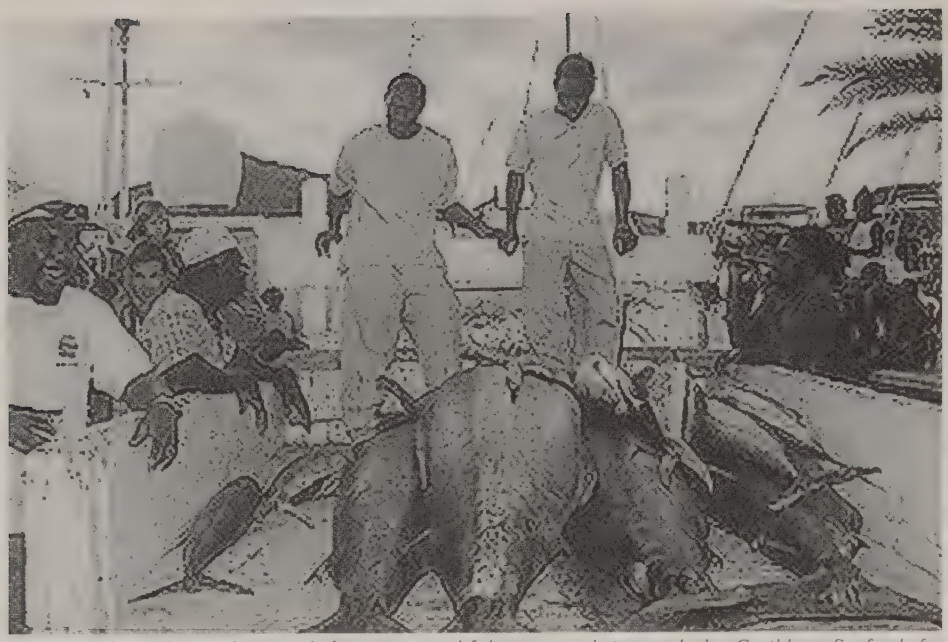

Photo 6.--These blue marlins caught by recreational fishermen are being trucked to Caribbean Seafoods for processing. ABSFA

blue light sticks. Trips are usually scheduled about once a week and last 3-4 days. They fish fairly close to the island on the Atlantic side, about 50-100 km offshore. The boat has a crew of four fishermen from Dominica and Guyana. They are unable to find Antiguans willing to work at sea for 2-4 days, much longer than the trips conducted by artisanal fishermen. The target species are tunas and swordfish, but marlin, dorado, wahoo, shark, and small tunas are also taken as bycatch. The oceanic pelagic fishery is highly seasonal and good catches are reported from October to April. The company reports continuing longline operations in 2000.[88] FD officials indicate that no longline operations have been reported in 2000.[89] A recreational fishermen says that he has not noted any longlining by Caribbean Seafood in 2000.[90] The authors are thus unable to determine the current extent of the company's longline operations.[91] Caribbean Seafood has three cold stores which can hold about 135 t of fish. Production is primarily marketed domestically. Small export shipments are made to other islands, including Montserrat, St. Barts, and St. Martins. The company does not export to the United States because of low prices and complicated regulations that make small-scale imports unprofitable. About 5-6 people are employed at the processing plant. Caribbean Fisheries is the only Antiguan company handling swordfish and other oceanic pelagics.[92]

were dressed aboard, like the swordfish and they are also finned. Further processing occurred at the Caribbean Seafood processing plant where some of the tuna, swordfish, wahoo, and shark were processed into fillets and steaks. The tunas and wahoos were also headed in the plant. Most of the swordfish was exported fresh to the United States. Shipments were reported in 1993-95 (appendix D2a1). The marlin (because of U.S. regulation prohibiting imports) were marketed domestically primarily in steaks both fresh and frozen. Much of the shark meat was marketed domestically fresh or frozen. The company also marketed the skins. Mako shark, however, was exported fresh-whole to the United States. The company also purchased and marketed domestically bottom species such as snapper, groupers, lobster, parrotfish, etc.[86] Caribbean seafood is a major purchaser of the sport fishing catch. The slice and filet it for sale to hotels and supermarkets.[87]

1996-97: All export shipments to the United States ceased in 1996 (appendix D2a1). No information is available on the operation of the company's two longliners during this period. They apparently were used to supply the local market.

1998-2000: Caribbean Seafood sold the *Stanley B* to a Guyana fishermen in 1998 and its share of the *Silver Star* to the co-owner, a Dominican fisherman. Both vessels were thus removed from the Antiguan fleet in 1998. With the proceeding from the sales, the company purchased a new vessel, the *Ocean Venture*. It is a 12-m fiberglass boat with a mainline of nearly 50 kilometers. It can set 400-500 hooks at depths of 20-35 meters. They use squid baits with green and

Hutchinson: This company reportedly handles seafood on Antigua. Fishery officials report that this information is erroneous and know of no such company.[93]

Shoprite Supermarket: This is a small retail store on Antigua. It is representative of several small retailers who handle fresh fish.[94]

Whites Fish Market: This company has been operated in St. Johns since 1984. It is privately owned by Silvester Whites. The company owns and operates the 10-m multi-purpose boat, the *Crystal*. It is used for both line and trap fishing. They have two small freezers. They also purchase the catch of the local fishermen and import product from Trinidad. They clean and pack fresh fish for the local market. They also export small quantities of lobster. Whites is

studying the possibility of handling live fish. They do not handle swordfish, but do process some tuna. One report indicated that they sell equipment (traps, wires, yellow light sticks, buoys, nets, and navigational equipment (GPS) to the fishermen.[95] Fishery officials report that they do not sell fisheries equipment and that they only handle fish.[96]

XII. Markets

A. Domestic

Much of the fish marketing on Antigua is informal with differences based on the size of the fishing operation.

Small boats: Fishermen deploying small boats almost always rely on their wives or relatives to market the catch. As in much of the Caribbean there is a notable division of labor among fishing families. Almost all of the fishermen are men. Wives and other usually female members of families are involved in the marketing sector of the fishing industry. There is normally minimal processing.

Large boats: The larger boat fishermen normally wholesale their catch to either of two processors where the gutting, scaling, storing and packaging takes place. Less than half of the fish landed goes through the Public Market in St. John's.[97] The pelagics are sold directly to the hotels or restaurants.[98]

Much of the Antiguan artisanal fisheries catch is landed at St. John's and sold at the Fish Public Market, which is operated by the Government. The fishermen deliver their varied catch to the market where it is retailed. Species like hinds, grunts, parrotfish, angelfish, butterfish, shark, various other demersals, and conch are commonly available. The fish is sold whole, but some enterprising ladies used to set up stalls to clean the fish. This is, however, no longer permitted. Retail customers in St. Johns now go the Antigua Fisheries Limited.[99] Smaller quantities are sold through private companies like Caribbean Seafood, Whites Fish Market, and a variety of small retail establishments like Shoprite Super Market. Much of the fish sold, however, is imported product.[100] Caribbean Seafood has landed both swordfish and billfish. Very little of the swordfish during the mid-1990s was marketed domestically--mostly low quality product. There was only a very limited domestic demand for swordfish at the time because local consumers were unfamiliar with the species.[101] The billfish catch, however, was marketed domestically because it could not be exported to the United States. Most of it was sold to local hotels and restaurants catering to tourists. Since 1995, CS's marketing patterns have significantly changed. All of the swordfish and tuna taken in the company's longline operation, is now marketed domestically, like the billfish.[102] The quantities involved, however, appear to be much smaller than the mid-1990s, when the company had two active longliners. The primary market continues to be the tourist hotels and restaurants. The St. James Club Hotel, for example, buys all the marlin from the local billfish tournament.[103] (See: "Companies.") Local consumers are becoming more familiar with oceanic pelagics. Artisanal fishermen also occasionally land a tuna or marlin and even a swordfish. Their catch generally appears in the local market.

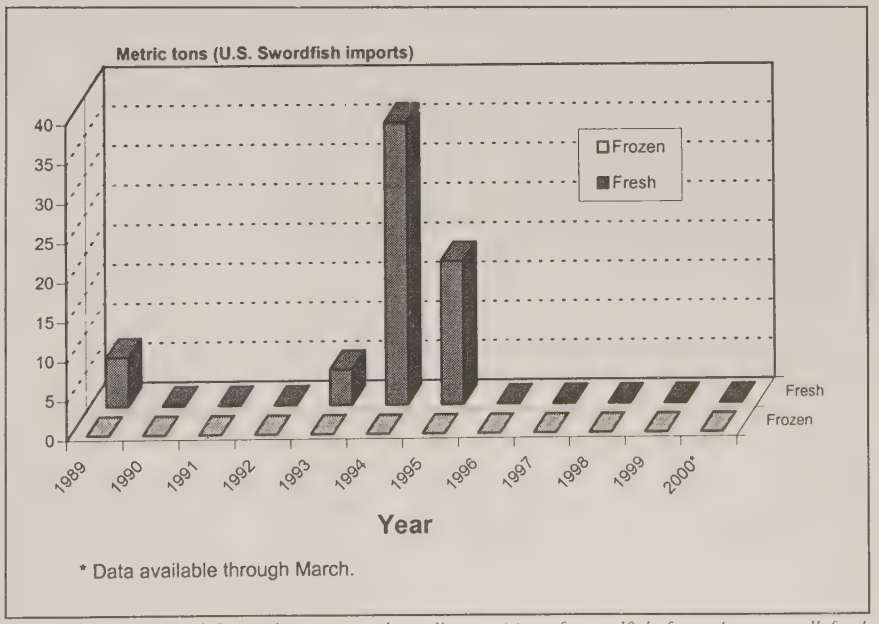

Figure 5.--The United States has imported small quantities of swordfish from Antigua, all fresh product. The last swordfish shipment was in 1995

B. Trade

1. Exports

Antiguan swordfish exports have been limited and only reported in a few years. The only know export shipments were to the United States, but no such shipments have been reported since 1995. Tuna shipments, which in the Caribbean are often a better indicator of longline activity, show the same pattern.

a. United States

Artisanal fishermen often export the choice species in their catch to the United States and France (Guadeloupe and Martinique).[104] As swordfish is only occasionally taken by the artisanal fishermen, the species rarely appears in these shipments.

Caribbean Seafood, Antigua's principal commercial fishing company, wanted to land its catch in Puerto Rico or the U.S. Virgin Islands. [105] U.S. law, however, prohibits most foreign fishermen from landing their catch in U.S. ports.[106] The company in 1995 airshipped much of its swordfish and tuna catch fresh, mostly to Miami.[107] (See: "Companies.") No swordfish or tuna shipments have been reported since 1995 (appendices D2a1 and D3).

U.S. import data shows only scattered swordfish imports. Some shipments were reported in 1989 and 1993-95 (appendix D2a1). (Specific data for Antigua is not available prior to 1989). The U.S. imported no swordfish, however, from 1990-92, even though Antiguan fishermen reported shipments.[108] The record year was 1994 when nearly 36 t of swordfish valued at over $300,000 was imported from Antigua (appendix D2a2). Smaller swordfish shipments of 18 t were reported in 1995. There have been no swordfish shipments to the United States since 1995. Caribbean Seafood also wanted to process its marlin catch in Antigua and air ship it to Puerto Rico. The United States, however, prohibits the importation of Atlantic billfish.

Longline fishermen on several Caribbean islands focus more on tuna than swordfish. Species like yellowfin or found at more shallow depths and thus are easier to catch. In addition, prices for fresh tuna have been strong in the late 1990s and early 2000s. Thus export shipments of tuna are often a better indicator of local longline activity than swordfish shipments. There have, however, also been no Antiguan tuna exports to the United Sates in recent years (appendix D3).

b. Other countries

There are no known swordfish exports to countries other than the United States. This is in part because of the strong market and attractive prices for swordfish in the United States. Another key factor is the frequent flight schedule to the United States, a key factor when shipping perishable fresh product.

2. Imports

Antigua imports seafood from other Caribbean islands. This is primarily due to the small local fishery and the substantial influx of tourists during the peak tourist season. The authors know of no swordfish imports, but as in other Caribbean islands, hotels and restaurants may have made small purchases.

XIII. Government Policy

The Antiguan fisheries agency is the Fisheries Division (FD) in the Ministry of Agriculture, Lands, and Fisheries. Antiguan officials currently report no commercial longliners and have issued no regulations on longlining.[109]

A. Fisheries law

Antigua and Barbuda, like other OECS member states, have a virtually identical fisheries law. The OECS has succeed in having member states enact a law drafted with FAO assistance. (For details see the Caribbean Overview). All Antiguan fishermen reportedly pay an annual registration fee of $200.

The Antiguan Government has issued no regulations governing longline fishing or specifically related to swordfish and other billfish.[110]

B. Limits

Antigua and Barbuda established a 12-mile Territorial Sea in 1982. The same act provided for archipelagic straight baseline, a contiguous zone of 24 miles, a shelf of 200 nautical miles or to the edge of the continental margin (CM), and a 200-mile Exclusive Economic Zone (EEZ).[111] The country signed the Law of the Sea Convention in 1983 and ratified it in 1989.

C. Licenses

Domestic fishermen are required to obtain an annual fishing license for their boats. The fee is based on the size of the boat. The species is not specified on the license as Antigua currently has an open fisheries policy. Vessels have to be registered if the fisherman wants to apply for a fishing license.[112]

The Government in the early 1980s reported issuing no specific laws on foreign fishing.[113] Antiguan officials confirm that the Government's policy is generally to prohibit foreign fishing. Their concern is to preserve the island's limited coastal resources fir the local artisanal fishermen.[114] Antigua is, however, cooperating with the OECS regional licensing scheme. No information is available on licenses formally issued to foreign fishermen, but the Government in the past appears to have reached arrangements with some foreign fishermen that were never announced publicly.[115]

D. Fisheries Policy

The Antigua and Barbuda Government recognizes that sustainable fisheries development cannot occur under the existing open access fishing regime. Officials report that the yield from the capture fishery is approaching the limits of the production from "wild" marine resources. Some observers suggest that the declining catch since 1984-86 suggests that the limits may have already been exceeded. The FD reports that fishermen are "fully utilizing the demersal resources of the EEZ and the government recognizes that any expansion of the fishery will be offshore targeting the large pelagics".[116] The FD is also interested in promoting aquaculture.[117]

E. Fisheries promotion

The Government in recent years has shown increased interest in promoting the expansion of the fishing industry, especially in targeting pelagic resources. The program for fisheries development is, in fact, geared toward transformation from the present traditional form of the government recognizes that any expansion of the fishery will be offshore targeting the large pelagics. The program for fisheries development is geared toward transformation from the present traditional form of fishing to a modern technology-oriented industry. The FD reports that consideration is being given to developing a small fleet of commercial vessels with the capability of exploiting large pelagic species within the EEZ and beyond through local entrepreneurs, joint ventures, or government fishery agreements.[118] Fishery officials stressed to the authors that they do not plan to grant fishing licenses to foreigners.[119]

The FD cooperated with the Caribbean Development Bank (CDB) and the Caribbean Food Corporation (CFC) in 1983 to develop the Antigua and Barbuda Fisheries Development Project. The Project was to provide Antigua Fisheries Ltd. six modern boats (about 15 m) for fishing outside the 90 fathom contour where few Antiguan fishermen operate. The vessels were to use snapper reel gear, but also experiment with trolling and longlining.[120] Few details on the results of the project are unavailable, but one report suggested that Canadian vessels were purchased that did not prove suitable for offshore operations.[121] One local observer reports that the Antiguan Government in 1980 obtained four vessels from Mississippi for trap fishing. Since the vessels had no stabilizers, they were not adequate for the fishery and were eventually sold. One of them is reportedly being used as a longliner in Barbados.[122]

The Antigua and Barbuda Government offers some subsidies to fishermen. Ice to store the catch is subsidized. Tax and duty free concessions are available for new fishing vessels, engines, fishing gear, and other related supplies. There is, however, no fuel rebate.[123]

XIV. Research

Antigua and Barbuda has a very limited research capability. The country has conducted no research on oceanic pelagics such as tunas and swordfish. Some international organizations, however, have worked with local officials to collect data needed for management measures associated with these and related species.

CARICOM: The Caribbean Community's (CARICOM) Fisheries Resource Assessment and Management Program (CFRAMP) initiated a biological data collection program for large pelagics in 1995.[124]

University of Georgia: Researchers from the University of Georgia work at the Jumby Bay Hawksbill Project. This is a turtle conservation project and the authors know of no work on longline interactions.[125]

XV. Bycatch

Antigua has one company which has conducted directed swordfish longline operations. The company reported catches of other oceanic pelagics as well as unintentional catches such as turtles. (See: "Companies.") Few details are available. Bycatch data for Antigua, as for other Caribbean islands, is very limited. Some idea of Caribbean bycatch trends are available by assessing the data reported by the U.S. longline fleet in its Caribbean operations (Caribbean Overview, series G appendices).[126] While this data does not pertain specifically to Anguillian waters or fishing strategies used by Anguillian fishermen, it does provide useful benchmark data. Some limited information is also available from neighboring Anguilla (Anguilla, appendix B2).[127]

Several species of sea turtles forage and or nest on or nearby Antigua and Barbuda. Biologists report turtles nesting and foraging on Antigua Rico and offshore islands. Hawksbills (*Eretmochelys imbricata*) nest at Jumby Bay.[128] There is an Antiguan program to protect hawksbills at this location.[129] Preliminary genetic analysis indicates that hawksbills nesting at Jumby Bay have been noted through genetic studies to be foraging off Cuba and Puerto Rico (Mona Island).[130] Fishery officials report that there are several nesting beaches on Antigua besides Antigua Rico and Jumby Bay and does not want to give the impression that these are the only two sites of importance. Officials stress that there are efforts to protect each of the important nesting sites.[131]

The one company conducting longline operations, Caribbean Seafood, reported unintentional catches of sea turtles, but no actual data is available.[132] There is no informational available on the extent of interactions between artisanal fishermen and sea turtles.

One study reported that 9 species of seabirds nest on Antigua and associated offshore cays. Some of the same species and one additional species nests on Barbuda. Eight different species are believed to nest on Redonda (appendix E). Both Barbuda and Redonda are believed to be very important seabird nesting sites.[133] The authors have no information on fishery interactions.

XVI. International

A. International Relations

1. Multilateral

Antigua and Barbuda have pursued fishery relations through only a few multilateral organizations. The country's primary multilateral fishery contacts have been with the Organization of Eastern Caribbean States.

CARICOM: Antigua is a member of the Caribbean Community (CARICOM). The authors, however, know of no participation in CARICOM fishery activities affecting swordfish.

OECS: Antigua is a member of the Organization for Eastern Caribbean States (OECS) and has adopted the OECS harmonized fisheries law and participates in the joint OECS fisheries enforcement program.

ICCAT: The International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for international coordination of research on and management of tuna and tuna-like species in the Atlantic. ICCAT has established catch limits and a

variety of other conservation and management measures for many of the species under its purview, including swordfish. The authors note little contact on the part of Antiguan officials with ICCAT. Antigua has not adopted the ICCAT management regulations for swordfish or other oceanic pelagics. ICCAT does not issue quotas to non-members, but expects them to fish responsibly in a way that does not impair existing management regimes (Caribbean Overview, appendix H3b). This would mean in the case of swordfish, basically abiding by the minimum size guidelines and not increasing the catch beyond the 1996 levels for countries with fisheries landing less than 100 t of swordfish.[134] This is somewhat difficult to assess because the DF does not collect swordfish catch data. The local catch appears to have peaked about 1994-95, but precise catch data for 1996 is not available to serve as a benchmark. As minimal quantities of swordfish are now being landed on Antigua, landings appear to be less than 1996 levels. Without actual data collected by the DF, however, this preliminary assessment can not be confirmed.

2. Bilateral

The authors know of no bilateral contacts affecting the swordfish fishery.

Cuba: Cuban longliners have primarily been deployed off West Africa. There has been some Cuban activity in the Wider-Caribbean (Caribbean Overview, appendix D3). There has not, however, been any Cuban longlining immediately around Antigua (Anguilla, figure 5 and appendix D).

Guadeloupe: Antiguan officials report some problems with artisanal fishermen on the nearby French island of Guadeloupe who fish on the reefs in Antiguan waters.[135] Press reports in 1982 indicated that the two Governments agreed to cooperate in fisheries management. Antiguan officials in 1986 held talks with French officials concerning the delimitation of the marine boundary.[136] Antiguan officials were reportedly considering possible access in exchange for French fisheries assistance.[137] Officials of the Guadeloupe Fishermen association met with representatives of the Antigua and Barbuda Fishermen association to discuss possible collaborative efforts.[138] Government officials in 1993 discussed possible access arrangements for small-scale fishermen. Guadeloupe fishermen were interested in deploying longlines and traps in Antiguan waters. The local Antiguan fishermen were reportedly outraged at the proposal and threatened to "attack" the French fishermen if they began fishing in Antiguan waters. The Government, as a result, quietly terminated the discussions with Guadeloupe officials. Generally hostile relations have developed between the artisanal fishermen on the two islands.[139] Antiguan officials confirm that there have been some recent discussions with French officials over fishery interactions between Antiguan and Guadeloupe fishermen.[140]

Japan: Japan has deployed the largest longline fleet in the Atlantic. The Japanese reported catches off Anguilla and the other Caribbean islands in the northeastern Caribbean as early as 1961 (Anguilla, appendix D). Japanese fishing in the northeastern Caribbean is described in more detail in the Anguillian chapter of this report and the Caribbean Overview. Antiguan officials concerned about adverse trade balances with Japan as well as Japanese distant-water fishing.[141] High officials, including then Deputy Prime Minister Lester Bird have complained of the trade problem and unlicensed fishing in the waters of Caribbean countries.[142] Officials in 1978 were studying possible action to restrict Japanese fishing.[143] The Japanese, however, have reported no swordfish catch and operations around Antigua since 1974 (Anguilla, appendix D).[144]

Korea: Korea also deployed a major Atlantic longline fleet. Operations off Anguilla have never been extensive, but the Koreans did take 8,100 t swordfish during 1978. Antiguan officials in 1983 were reportedly finalizing arrangements with the Korean Government to contract Korean fishery technicians.[145]

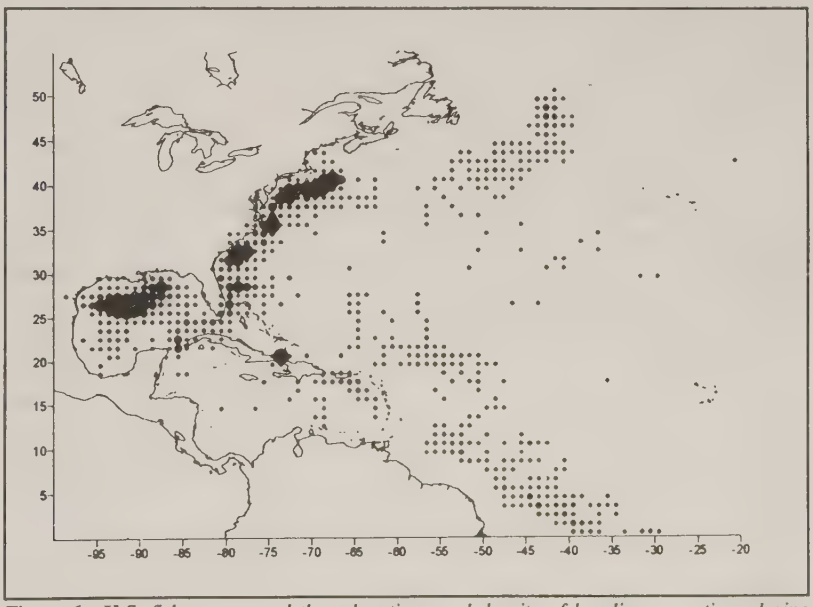

Figure 6.--U.S. fishery reported these locations and density of longline operations during 1997. Jean Cramer

No Korean catches off Antigua have been reported since 1986 (Anguilla, appendix D). Korean Atlantic longline operations were significantly scaled back in the 1990s and there are no known operations off Antigua.[146]

Martinique: Fishery officials report in 2000 that there are currently no ongoing talks with French officials concerning Martinique.[147]

St. Kitts: Antiguan officials have held talks with St. Kitts officials concerning the delimitation of the marine boundary.

Spain: Spanish fishermen do not operate in the Wider-Caribbean (Caribbean Overview, appendix D6). This of course includes the area around Antigua (Anguilla, appendix D). Spanish fishermen have reported no swordfish fishing off Antigua.[148] Enforcement officials and local fishermen do not report sighting Spanish longliners.

Taiwan: Taiwan, like the Japanese, initiated Caribbean-area longline operations in the 1960s. The primary Taiwan activity has been to the north of the Caribbean, as far as Bermuda, where they have targeted albacore to supply Puerto Rican canneries packing "white meat" tuna.[149] Many of the vessels have operated out of St. Maarten.[150] The focus of the Taiwan operation is tuna, but swordfish and other billfish are taken.[151] Taiwan fishermen are the only Asian longliners currently active in the northeastern Caribbean (Anguilla, figure 5 and appendix D). Taiwan operations in the northeastern Caribbean are discussed in more detail in the Anguillian chapter of this report and the Caribbean Overview.

United States: U.S. longliners are active in the northeastern Caribbean, operating from San Juan and the U.S. Virgin Islands. At least one U.S. operator has been active on Antigua. Much of the U.S. effort in the northwestern Caribbean has been west of Antigua or in the Atlantic to the north and east of Antigua (figure 6).[152]

B. Joint ventures

There has been some limited joint venture activity in Antigua-Barbuda.

Netherlands: An unconfirmed report indicate that Antigua Fisheries Ltd. participated in a joint venture with a Dutch group to do some exploratory fishing for migratory species. No details are available on the outcome.

United States: The United States began developing a longline fleet targeting yellowfin tuna in the Gulf of Mexico. Beginning in the mid-1980s, U.S. longline fishermen began targeting swordfish after commercial stocks were encountered off the Florida Atlantic coast.[153] A U.S. company, Merrit Seafoods, established a deep-sea fishing operation in the mid-1980s targeting swordfish. One Antiguan source indicates that Merrit was operating about 40-50 vessels, mostly based in San Juan during the early 1980s. The company reportedly achieved remarkable catches (450 kg per night). Antiguan sources claim that formal arrangement between Merrit and the Antiguan Government was never signed and made public. Local fishermen complained about the foreign fishing and were never told of the arrangement with Merrit. As swordfish catches decreased in the 1980s Merrit withdrew their vessels from the area, preferring to focus more on boat building. No details are available on the current status of the operation.[154] Fishery officials report that as of 2000 there were no U.S. companies active on Antigua.[155] A small number of the swordfish/tuna U.S. longliners are still active in the wider-Caribbean, including grounds to the north and east of Puerto Rico. The U.S. fishery is highly seasonal, primarily conducted during the winter months. U.S. pelagic longline fishermen in the Caribbean often fish in the northeastern Caribbean, but generally to the southeast of Puerto Rico, south of Antigua (figure 6). There also is some fishing north and northeast of Antigua, but generally outside of Antiguan waters.[156]

C. Foreign assistance

Some countries and multilateral agencies have provided fisheries assistance to Antigua and Barbuda.

Canadian International Development Agency (CIDA): CIDA has provided assistance to Antiguan fishermen over a 10-year program. CIDA is currently providing assistance through the CFRAMP project.[157]

Caribbean Development Bank (CDB): The CDB in 1983 approved a $3.2 million contribution to support a Government fisheries development project. The plan involved the purchase of six fishing boats. A 1983 press report indicated that two had arrived and two were being constructed locally.[158] Longlining was a minor aspect of this project. (See "Government Policy: Fisheries promotion".) Reports from the mid-1980s indicate that the CDB was working through Antigua Fisheries Limited and that technical difficulties had been encountered in implementing the CDB-financed project.[159]

Japan: The Japanese in the late 1990s financed the modernization of the St. John's fishing market and port facilities.

Korea: Government officials in 1983 were reportedly finalizing arrangements for a Korean fisheries expert to train local fishermen.[160]

XVII. Enforcement

Antigua and Barbuda have a very limited enforcement capability. The country has a number of enforcement problems with neighboring islands. Local observers report that Antigua's limited enforcement capability has made it impossible to enforce fishing regulations and prevent foreign fishing.[161] There are currently no foreign longliners fishing with Antiguan fishing licenses. One observer believes that since the Government does not have enough funds to support enforcement of fishing regulations, foreign fishermen operating in the outer area of the EEZ in the Atlantic can easily fish illegally in Antiguan waters. There are no known seizures of foreign vessels by Antiguan officials.[162] Antiguan Government officials believe that foreign fishing has adversely affected the profitability of Antiguan longline operations.[163]

Only few details are available on enforcement problems with individual neighboring islands and distant-water fishing countries.

Guadeloupe: French fishermen, mostly from Guadeloupe, fish illegally off Antigua and Barbuda because the French fishermen have badly overfished their own waters.[164] The large area of shelf between Antigua and Barbuda is a alluring temptation to the Guadeloupe fishermen who particularly prize the reef species which can be taken there.

Taiwan: Taiwanese fishermen have reportedly fished illegally off Antigua. Government and recreational fishermen believe that the Taiwan vessels, based on St. Maarten's, are affecting local stocks.[165] One observer reports that the Taiwan fishermen concentrate their efforts in offshore waters, usually at least 160 km offshore. The Taiwan fishermen tend to stay well off the coast because their gear consists of longer longlines with 2,000-3,000 hooks targeting albacore. Some local fishermen believe that Taiwan fishing for tuna is adversely affecting wahoo catches.[166]

United States: One Antiguan observer charges that much of the unlicensed foreign fishing is conducted by U.S. fishermen. He claims that most of the unlicensed U.S. fishing is done by U.S. fishermen off the west coast (south of Montserrat and Martinique).[167] Antiguan officials report no problems with U.S. fishermen, but has seen noted U.S. fishermen around the French islands, especially Guadeloupe.[168] The United States Government has attempted to assist Antiguan authorities with marine patrols, by providing the patrol boat *Defender* in 1984.[169]

XVIII. Future Trends

Antiguan fishermen have attempted to initiate a commercial longline fishery for swordfish, tunas, and related species. Different groups have operated a few longliners and small exports have been reported to the United States. The longline operations, however, have met with only limited success. Some longlining was reported in the late 1980s and one company indicated that it had some success in the mid-1990s. That company was operating one U.S.-built multi-purpose vessel in 2000, but markets all of the catch domestically. No swordfish or tuna exports have been reported to the United States since 1995. The sole longline operator on Antigua in 2000 declined to provide details on his operation. The fact that he only operates one small longliner and no other Antiguan fishermen currently deploy commercial longliners, suggests that the fishery is unlikely to expand significantly in the near future. The current operation appears to provide some catches to profitably supply the local tourist industry. Catches are not, however, adequate to justify export shipments. The government has expressed a desire to expand the pelagic fishery but the authors know of no concrete steps taken to promote the development of a pelagic longline fishery.

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Endnotes

SECTION I. (Overview)

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2. Fisheries Division, "Antigua and Barbuda Fisheries Division," internet posting accessed May 19, 2000: http://caricom-fisheries.com/antigua-fisheries/overview.html
3. Anonymous Fisheries Division official, personal communications, August 23, 2000. The official subsequently complained that in the draft we provided prior to publication that he was misquoted. Unfortunately he declined to indicate what the inaccuracies were or even the nature of the inaccuracies so they could be corrected, which of course we would have been pleased to do.
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SECTION II. (Species)

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20. R. Kreuzer and E. Oswald, "Report on mission to Antigua, Barbados, Dominica and St. Lucia," *WECAF Reports,* No. 10 (WECAF: Panama City, June, 1978), p. 5.
21. Information provided by the vessel owner, Lucian Barreto. U.S. Embassy, Antigua, "Request for information on fish importation," message number 1435, October 10, 1990 and Lucian Barreto, Owner, Caribbean Seafood, personal communications, January 17, 1996.
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SECTION IV. (Fleet)

23. Anonymous Fisheries Division official, *op. cit.*, August 23, 2000.
24. Anonymous Fisheries Division official, *op. cit.*, August 23, 2000.
25. Fisheries Officer James reports that vessel registration is free, but the fishermen have to pay for a fishing license. He estimates that his office has issued 150-300 such licenses. The precise number was unavailable at the time of the interview. The Fisheries Division does not maintain a breakdown on the types of vessels to which these licenses were issued. James, *op. cit.*, May 24 and August 23, 2000 and George Looby, Fisheries Division, personal communications, June 2, 1999.
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36. Looby, *op. cit.*, June 2, 1999.
37. Barreto, *op. cit.*, December 20, 1995.
38. Anonymous Fisheries Division official, personal communications, May 24, 2000.
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41. Antigua and Barbuda Government, *Development of Tourism Infrastructure at Parham Harbour, Antigua: Mater Development Plan* (OAS: Washington, DC, 1995), 105 p.
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SECTION V. (Shipyards)

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46. FAO, "Antigua and Barbuda," *FAO Profile* (FAO: Rome, 1986), p. 2.
47. Barreto, *op. cit.*, December 20, 1995.

48. J. Chaiton/HIAMP, "The future of commercial longline fishing in the 1990s in the eastern Caribbean," in W. Hunte, H.P. Oxenford, and G. McConney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados," *Barbados Development Bank Technical Report* (Barbados Development Bank; Bridgetown, 1993), pp. 7-9.
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51. It is unclear why the number of marlin mentioned does not agree with the appendix. The authors may not have counted fish that were tagged and released. CARICOM/CFRAMP Pelagic and Reef Fishes Resource Assessment Unit, "Report of the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP)," *ICCAT Collective Volumes of Scientific Papers*, SCRS/94/128, p. 263.
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Appendices

Series A: Fleet
Series B: Catch
Series C: Sport Fishing
Series D: Trade
Series E: Seabirds

Appendix A.--Antigua. Longline fleet, 1999

Vessel	Length	Owner	Acquired	Status
	Meters			
Jenny B	11.6	Antiguan*	1988**	Inactive since 1990
Joe Pri	18.3	Antiguan*	1988**	Sold in 1990***
Ocean Venture	12.2	L. Barreto	1998	Active since 1998
Sea Hawk	11.6	L. Barreto	1988	Sold in 1990
Silver Star#	15.5	L. Barreto*****##	1990	Active until 1998
Stanley B	15.5	L. Barreto****	1990	Active until 1998

* Unidentified Antiguan
** The first reported operations known to the authors were in 1988, but the vessels could have been deployed earlier.
*** Sold to a Guyanese company and converted for shrimp trawling
**** Barreto formed Caribbean Seafoods in 1992 which currently operates the vessels.
# One report indicates that this was a Dominican (the Commonwealth of Dominica, not the Dominican Republic) longliner which was licensed to fish in Antiguan waters.
Barreto was the Antiguan co-owner. The other owner was a Dominican.
Source: Various

Appendix B1.--Antigua and Barbuda 1980-96

Year	Catch
	Metric tons
1980	1,601
1981	1,777
1982	2,004
1983	2,246
1984	2,246R
1985	2,246R
1986	2,246R
1987	2,000F
1988	1,500F
1989	1,000F
1990	885
1991	1,498
1992	1,712
1993	580
1994	629
1995	470
1996	530F
1997	500F

R - Repetition of data previously reported by the country
F - FAO estimate
Source: FAO, *Yearbook of Fishery Statistics*, (FAO: Rome, various years).

Appendix B2.--Antigua. Swordfish catch, 1990-99

Year	Catch			
	FAO	ICCAT	NMFS*	CS**
		Metric tons		
1989	NA	NA	8.7	NA
1990	NA	NA	-	40E
1991	NA	NA	-	40E
1992	NA	NA	-	40E
1993	NA	NA	6.3	40E
1994	NA	NA	50.1	40E
1995	NA	NA	25.5	40E
1996	NA	NA	-	NA
1997	NA	NA	-	NA
1998	NA	NA	-	NA
1999	NA	NA	-	NA

NA - Not Available
E - Estimate
* Based on U.S. import trends. This is a minimum estimate as there were also probably some domestic consumption. U.S. imports (appendix D2a1) were converted to live weight based on a conversion factor of 1.4.
** No precise annual data is available, but the company estimates catches at 30-50 tons for 1990 to 1996. Company officials indicate that their accountant advises against providing any subsequent data or estimates.
Source: *Yearbook of Fishery Statistics*, various years (FAO data). *Statistical Yearbook*, various years (ICCAT data). U.S. Bureau of the Census, unpublished data (NMFS data). Lucian Barreto, owner, Caribbean Seafood (CS), personal communications, January 17, 1996.

Appendix C.--Antigua. Sports Fishing Tournament catch, 1994

Species	Individuals	Quantity
	Number	Kilograms
Tunas	10	121.7
Billfish		
Sailfish	1	15.5
Marlins		
White	1	33.2
Other	5	917.3
Dorado	53	585.1
Wahoo	51	544.1
Kingfish	7	786.9
Cero mackerel	1	4.5
Total	129	3,008.3

Source: Pelagic and Reef Fishes Resource Assessment Unit, "Report of the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP)," *ICCAT Collective Volumes of Scientific Papers*, SCRS/94/128, pp. 265.

Appendix D1.--Antigua. Swordfish exports by destination, 1991-2000

Destination	Year										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	Metric tons										
United States	-	-	-	4.5	35.8	18.2	-	-	-	-	-*
Japan	-	-	-	-	-	-	-	-	-	-#	NA
European Union	NA	-	-	-	-	-	-	-	-P	-P	NA
Others**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	NA	-	-	4.5	35.8	18.2	-	-	-	-	NA

NA - Not available
P - Preliminary
Through November
* Through June
** Swordfish shipments to other countries are believed to be non-existent or negligible.
Source: Various.

Appendix D2a1.--United States. Swordfish imports from Antigua, 1988-June 2001

Year	Commodity		Total*
	Fresh	Frozen	
	Metric tons		
1988**	NA	NA	NA
1989	6.2	-	6.2
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	4.5	-	4.5
1994	35.8	-	35.8
1995	18.2	-	18.2
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999	-	-	-
2000	-	-	-
2001	-#	-#	-#

* Totals may not agree due to rounding.
** Prior to 1989, Antigua-Barbuda import data was included in the "Leeward-Windward Islands" basket category. See Caribbean (appendix F2c1).
# Through June.
Source: U.S. Bureau of the Census.

Appendix D2a2.--United States. Swordfish imports from Antigua, 1988-June 2001

Year	Commodity		Total*
	Fresh	Frozen	
	US$1,000		
1988**	NA	NA	NA
1989	30	-	30
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	20	-	20
1994	302	-	302
1995	160	-	160
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999	-	-	-
2000	-	-	-
2001	-#	-#	-#

* Totals may not agree due to rounding
** Prior to 1989, Antigua-Barbuda import data was included in the "Leeward-Windward Islands" basket category. See Caribbean (appendix F2c2).
# Through June.
Source: U.S. Bureau of the Census.

Appendix D2b.--United States. Monthly swordfish imports from Antigua, 1990-June, 2001

Month	Year											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	Metric tons											
January	-	-	-	-	-	4.3	-	-	-	-	-	-
February	-	-	-	-	1.8	2.2	-	-	-	-	-	-
March	-	-	-	-	1.9	2.1	-	-	-	-	-	-
April	-	-	-	-	5.3	1.1	-	-	-	-	-	-
May	-	-	-	3.5	3.5	2.9	-	-	-	-	-	-
June	-	-	-	-	1.9	2.1	-	-	-	-	-	-
July	-	-	-	-	1.7	-	-	-	-	-	-	
August	-	-	-	-	-	1.0	-	-	-	-	-	
September	-	-	-	0.9	3.1	-	-	-	-	-	-	
October	-	-	-	-	3.5	0.6	-	-	-	-	-	
November	-	-	-	-	8.0	0.8	-	-	-	-	-	
December	-	-	-	-	5.0	0.8	-	-	-	-	-	
Total	-	-	-	4.5	35.8	18.2	-	-	-	-	-	

Source: U.S. Bureau of the Census.

Appendix D3.--United States. Tuna imports from Antigua, 1990-2000

Year	Imports	
	Quantity	Value
	Metric tons	US$1,000
1990	-	-
1991	-	-
1992	-	-
1993	0.5	2.5
1994	2.0	12.7
1995	4.1	27.4
1996	-	-
1997	-	-
1998	-	-
1999	-	-
2000	-	-
2001	-#	-#

* Totals may not agree due to rounding.
# Through April.
Source: U.S. Bureau of the Census.

Appendix E.--Antigua and Barbuda#. Seabird nesting, 1984

Area	Information	Species*	Known** threats	Importance***
Antigua	Reasonable	3?, 5, 11, 12, 16, 18?, 19, 20, 22	Ex?, Ha	Important
Barbuda	Reasonable	3?, 6?, 7, 11?, 12	Ex, ?	Very important
Redonda	Reasonable	3?, 5?, 6?, 7?, 9, 10, 18?, 22	?, Ex?	Very important

And associated cays
* Species: 3 - Puffinus I. lherminieri; 5 - Phaethon aethereus; 6 - P. lepturus; 7 - Fregata magnificens; 9 - S. sula; 10 - S. leucogaster; 11 - Pelecanus occidentalis; 12 - Larus atricilla; 16 - S. dougallii; 18 - S. anaethetus; 19 - S. fuscata; 20 - S. (albifrons) antillarum; 22 - A. stolidus
** Threats: Ex - exploitation of eggs, young or adults; Pr - predators, generally introduced mammals; Ha - habitat destruction or disturbances; Po - pollution; Fi - fisheries
*** A rough subjective rating of relative importance of area for breeding seabirds.
Source: Ruud van Halewyn and Robert L. Norton, "The status and conservation of seabirds in the Caribbean," in J.P. Croxall, P.G.H. Evans, and R.W. Schreiber (eds.), "Status and conservation of the world's seabirds," *ICBP Technical Publication*, No. 2 (ICBP: Cambridge, 1984), pp. 175-176.

CHU Y CLUB
CHUB CAY, ANDS, BAHAMAS
CHUB CAY CLUB
STAN WALL

3

BAHAMAS

The Bahamas has a small fishing industry which since the mid-1980s has expanded significantly. The industry is a multiple gear (trap and diving) fishery targeting spiny lobster. There is no known pelagic longlining activity, although swordfish and tunas could be taken in the western Bahamas along the Gulf Stream. U.S. longline fishermen are active in U.S. waters off Florida, but there is no Bahamian longline activity on the Bahamian side of the marine boundary. Swordfish and tunas, however, are present along both the eastern and western sides of the Gulf Stream. The resource is available, but the Bahamian fishermen are mostly focused on the lobster fishery. There have been some attempts to initiate a longline fishery. Because of the bycatch associated with the longline fishery, both artisanal and sport fishermen complained when longlining trials were conducted in the late 1980s. About 10 longliners were eventually deployed, but trade data suggests they had very limited success. Tourism is the Bahamas' major industry and sport fishing is an important component of the tourist industry. Sport fishermen were very concerned about the possible impact of longlining on species taken by sports fishermen--especially billfish and sharks. The Bahamas has a well developed diving industry and shark dives are an important attraction. The Government has not promoted the development of a longline fishery, and because of the complaints from both artisanal and recreational fishermen, has placed very stringent conditions on longlining. Thus Bahamian fishermen under the current regulatory regime may thus find it difficult to launch a pelagic longline fishery for swordfish, tunas, and related species.

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Figure 1.--Map of the Bahamas

I. Overview

A. Background

The Bahamian Islands were discovered by Columbus in 1492, but the Spanish never settled the islands. Spanish slave traders captured the native Lucayan Indians to work gold mines in Hispaniola, and within 25 years, all Lucayans perished. A group of English and Bermudian religious refugees, the Eleutheran Adventurers, in 1647 founded the first permanent European settlement in the Bahamas and gave Eleuthera Island its name. Similar groups of settlers formed governments in the Bahamas until the islands became a British Crown Colony in 1717. The islands have been governed by Britain except for a brief period in the 18th century.

The Bahamas has had a colorful history. The first British Royal Governor, a former pirate named Woodes Rogers, brought law and order to the Bahamas in 1718, when he expelled the buccaneers who had used the islands as hideouts. During the American Civil War (1861-65), the Bahamas prospered as a center of Confederate blockade-running. After World War I (1914-18) and the advent of prohibition in the United States, the islands served as a base for American rumrunners. During World War II (1939-45), the Allies centered their flight training and anti-submarine operations for the Caribbean in the Bahamas. Since then, the Bahamas has developed into a major tourist and financial services center.

Photo 1.--These lobsters were caught by members of the Bahamas' South Andros Cooperative Society. The tails are being cleaned and weighed for export to the United States.

Bahamians achieved self-government through a series of constitutional and political steps, attaining internal self-government in 1964 and full independence within the Commonwealth on July 10, 1973. As a Commonwealth country, its political and legal traditions closely follow those of the United Kingdom. The Bahamas recognizes the British monarch as its formal head of state, while an appointed Governor General serves as the Queen's representative in the Bahamas. The government is a Westminster-style parliamentary system. The bicameral legislature consists of the popularly elected House of Assembly and the appointed Senate.

The Bahamas is an archipelago made up of 29 major islands, cays, and rocks. It is located in the Atlantic about 80 kilometers (km) off the coast of Florida and extends south and southeast toward the northern coast of Cuba and Haiti. The country's Exclusive Economic Zone (EEZ) is about 100,000 square miles, one of the larger EEZs of the small island countries in the Caribbean.

B. Fishing industry

The Bahamian fishing industry has traditionally played an important role in the country's way of life. Fish is one of the major food items in the diet of Bahamians and the industry provides important employment opportunities. About 3,000 full and part-time fishermen were active in the early 1980s, but this declined to about 2,500 fishermen by the late 1980s as economic development in the Bahamas provided attractive economic opportunities in other sectors, especially tourism. The Bahamian fishery is conducted on shallow banks which are notable for the diversity of species.

The country's small fishing industry harvests about 10,000 metric tons (t) of fish and shellfish annually (appendix B1).[1] Fishermen increased catches from only 5,000 t in 1980 to a peak of 10,100 t in 1993. Since 1993 the catch has totaled 9,600-9,800 tons. The 1996 catch was 9,900 tons. Fishermen in

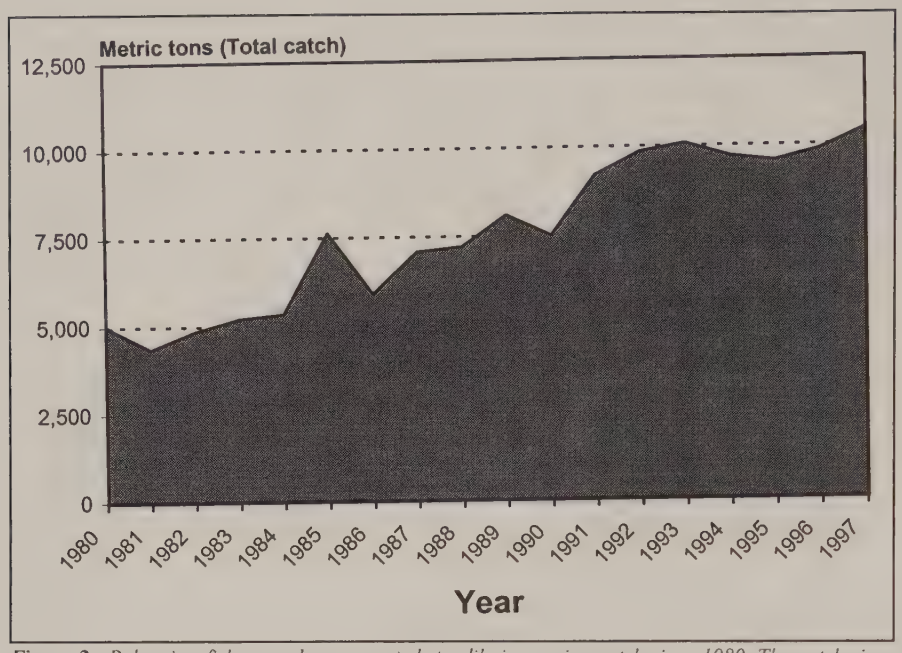

Figure 2.--Bahamian fisherman have reported steadily increasing catch since 1980. The catch since 1993, however, has been relatively unchanged.

1997 reported a new record catch of 10,400 tons.

The Bahamian fishing industry is dominated by the fishery for spiny lobster which the Bahamians refer to as "crawfish". This is an inheritance from their British association. The British refer to lobsters without claws as crayfish. Spiny lobster is abundant on the many reefs, islands and cays which make up the Bahamas. The lobster catch totaled 7,800 t in 1997, nearly 75 percent of the catch. Many countries have low value species like anchovy, sardine, or jack mackerel which make up a substantial part of the fisheries catch. The authors know of no other country where a high value species like lobster so dominates the fishing industry.

The Bahamian lobster fishery employs a variety of gear. The main gear is the "casita" that fishermen variously refer to as a trap or "condo". The standard Caribbean trap is also used, but is not as popular as the casita. Along with the casita, some fishermen also dive using air compressors and a "crawfish hook" which in recent years has mostly replaced the Hawaiian sling.[2] The authors know of no longlining for pelagic species. Some finfish are taken with drop lines, but the great bulk of the catch is lobster taken with traps. There is also a small fishery for conch. Other gear used by the fishermen is spear gear (Hawaiian sling), seine nets, and hook and line.[3] Species of finfish targeted by the fishermen include groupers, jacks, snappers, and grunts, but a wide diversity of other species are also taken.

The Bahamian fishery is conducted year round. There is a closed season for the important lobster resource (April 1 through July 31). The turtle harvest was also closed (April 1 through July 31).[4]

The Bahamian fishing industry makes a significant contribution to the national economy. Most of the Bahamian fisheries catch is exported, primarily to the United States. Export shipments in 1998 totaled nearly $60 million. Imports in 1998 were estimated by FAO at only $4 million--although $6-8 million was common in previous years (Caribbean Overview, appendix F1a-b).

FAO reports that exploratory fishing and resource assessment surveys have revealed substantial resources of both deepwater and shallow water species on the Bahama Banks. A pilot project to assess the feasibility of deepwater longlining has shown that bottom longlining for snappers and groupers could be profitable.[5] U.S. longline fishermen operating off Florida have demonstrated the feasibility of pelagic longlining along the Gulf Stream. Existing fishermen

Photo 2.--While Bahamian fishermen focus on lobster, they also take conch and a wide variety of finfish. Charles Fuss

and environmental groups, however, have objected to the introduction of longlining--leading to the imposition of strict controls in the mid-1990s.

II. Species

A. Spawning

The spawning grounds for swordfish is primarily deduced by the location and abundance of swordfish. One 1983 study reported that there is relatively little spawning within the Caribbean, but considerable spawning activity is reported off western Cuba, both in the Yucatan and Florida straights. Most of it occurs north of western Cuba in the Gulf of Mexico. There are especially large concentrations of swordfish larvae off Florida's Atlantic coast, in particular southern Florida to the west of the Bahamas. Most of these larvae are found within or to the west of the Gulf Stream in the U.S. EEZ. Relatively limited quantities of larvae have been found in Bahamian waters or off eastern Cuba.[6] One detailed assessment of swordfish larvae did report the presence of swordfish larvae in central Bahamian waters.[7] A more recent analysis shows a similar pattern of larval concentrations to the west of the Bahamas, but a more pronounced concentration in the eastern Gulf of Mexico away from the Cuban coast and the Yucatan and Florida Straits than in the earlier study. The numbers of small larvae were particularly notable in the eastern Gulf of Mexico, strongly suggesting that this is a major spawning ground. Most of the larvae were found in the frontal zone associated with the Gulf Stream than the Gulf Stream itself. Away from the Gulf Stream, swordfish larvae are rarely found within Bahamian waters.[8]

B. Distribution

The presence of swordfish and associated species in Bahamian waters is strongly suggested by the fishing patterns reported by U.S. fishermen off Florida. U.S. fishermen set extensively in the waters just north of the Bahamas as well as west of the Bahamas along the Florida peninsula, apparently just outside the country's 200-mile limit.[9] The sets form this discernable pattern only because the U.S. fishermen do not have access to Bahamian waters. This pattern strongly suggests, however, that swordfish and associated oceanic pelagics are present in northern Bahamian waters.

Photo 3.--The Bahamas is composed of a few large islands and a much larger number of small cays and islets. Mark Farber

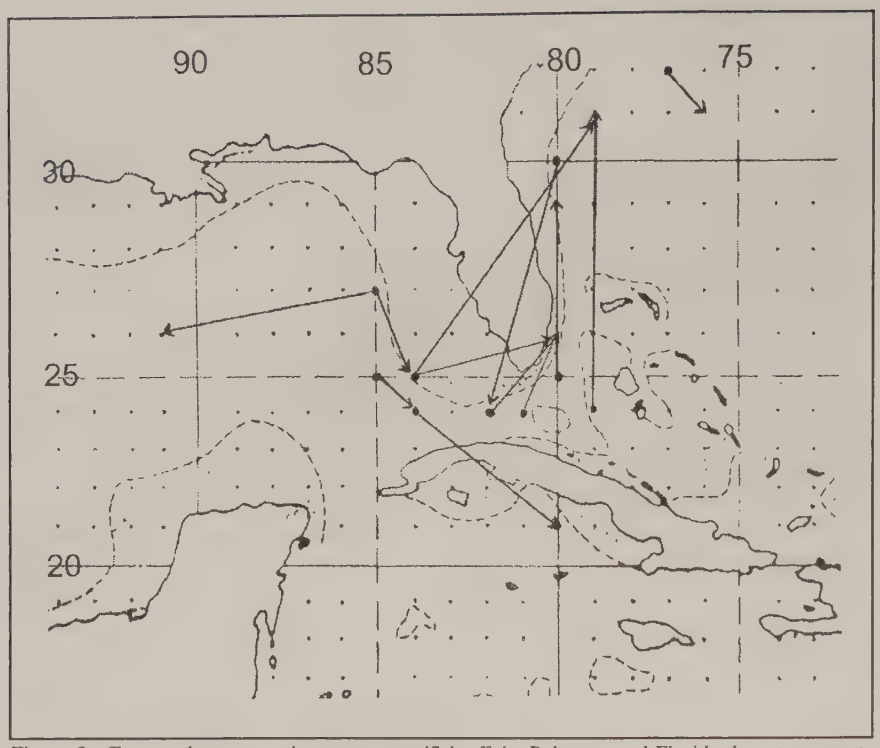

Figure 3.--Tag results suggest that some swordfish off the Bahamas and Florida do not appear to make long migrations. This cannot be confirmed, however, until data from the new archival tags is available.

C. Migration

Migration patterns for swordfish are not fully understood. Tagging studies are, however, providing increasing insights on migratory movements. Swordfish move out of the Caribbean, following the continental shelf and the Gulf Stream north to rich feeding grounds off the northeastern United States and Canada. This means that the fish move through western Bahamian waters. Canadian researchers report tagging a swordfish off Nova Scotia that 1 year 4 months later was taken east of the Bahamas (about 28°N,71°W) (Caribbean Overview, appendix C3).[10] This suggests the possibility that the Bahamas or waters east of the Bahamas may lie along a theorized circular migratory path following the North Atlantic Sub-Tropical Gyre.[11]

Available tagging data is limited. Tag returns do, however, appear to substantiate a northern movement along the Gulf Stream from the Gulf of Mexico and Caribbean to northern feeding grounds (Caribbean Overview, appendix C3). While some tag returns appear to substantiate northern movement along the Gulf Stream, there is also some indication that some of the fish, as the waters cool, may be retracing their steps and moving south (Caribbean overview, appendix C3). There is also some evidence that there may be residential populations (figure 3). The migration patterns are difficult to assess looking only at the vector lines, but size and months at large data is available in the associated appendix. The new archival tags that are now available will in a few years provide much more detailed information about migratory patterns.

D. Seasonality

Bahamian fishermen do not target swordfish and thus there is no catch data to provide insights on seasonality. U.S. fishermen operating to the west of the Bahamas right up to the marine boundary provide some insights on swordfish seasonality in the western Bahamas. U.S. fishermen report highly seasonal operations. Most of the U.S. catch out of Florida ports

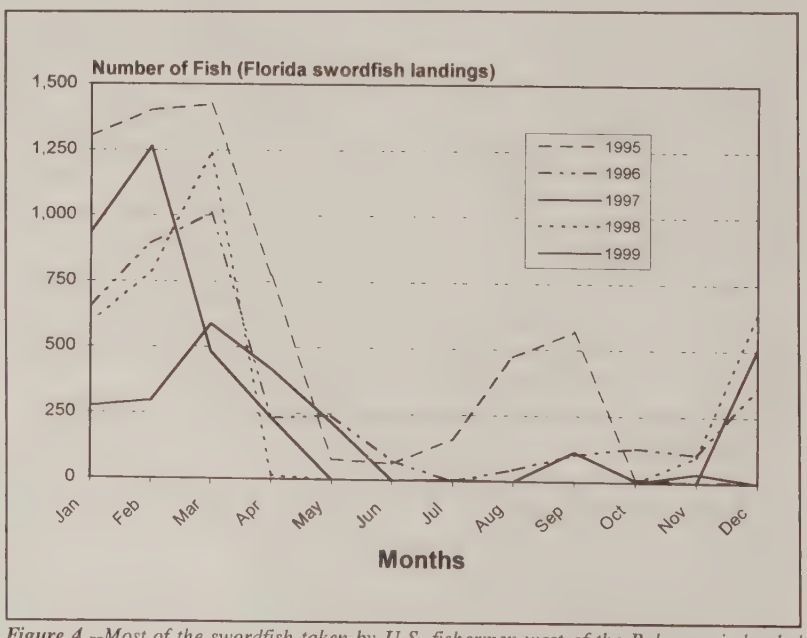

Figure 4.--Most of the swordfish taken by U.S. fishermen west of the Bahamas is landed from January to March. Catches from April to November are usually minor, with few exceptions.

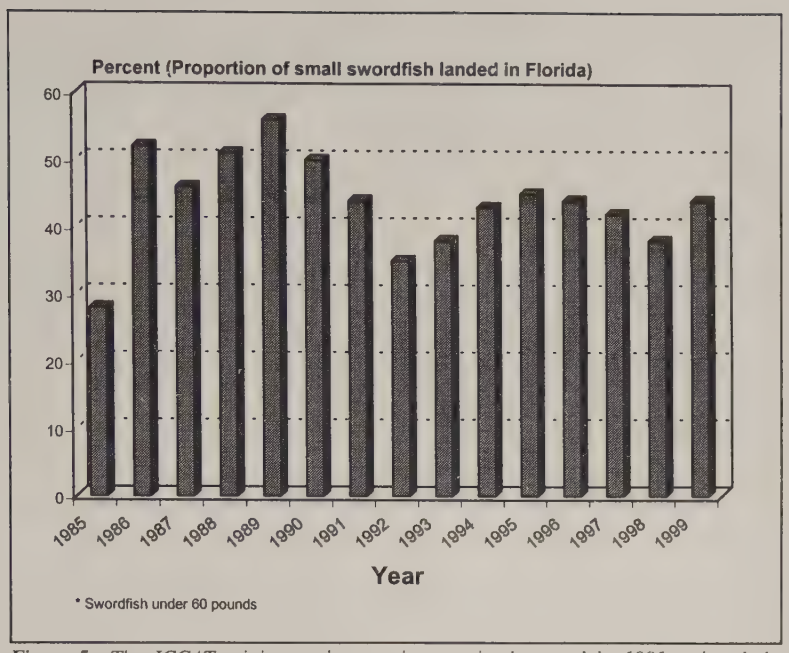

Figure 5.--The ICCAT minimum size requirement implemented in 1991 reduced the proportion of small fish being landed in Florida to the west of the Bahamas. Since then the proportion has increased slightly.

is landed from January to March with lesser catches in December and April. Occasionally good catches are reported in other months (appendices A12-16). Unusually good catches were, for example reported during August and September 1995. While fisheries dependent data must be dealt with carefully, in a heavily fished fishery like swordfish longlining, catches probably are a good indicator of actual seasonal abundance.

E. Populations

The authors have no data on swordfish populations throughout the Bahamian archipelago. Given the water depths over large areas of the Bahamas, swordfish populations are likely to be limited. The major concentrations is likely to be in the western Bahamas along the Gulf Stream. U.S. fishermen report significant effort and swordfish catches all along the western border with the Bahamas. There are also swordfish catches north of the Bahamian 200-mile Exclusive Economic Zone.[12] This suggest swordfish are present in the northern as well as western Bahamian waters.

F. Sizes

No information is available on the sizes of swordfish found in Bahamian waters. Data on size trends of swordfish being caught by U.S. fishermen out of Florida ports are probably a good indicator of the fish available on the Bahamian side of the marine border along the eastern fringe of the Gulf Stream. U.S. fishermen were landing very substantial numbers of small fish (individuals under 60 lb/27 kg) during the 1980s (appendices A2-6). Small fish exceed 50 percent in 1989. When the ICCAT minimum size rule was implemented, U.S. fishermen off Florida substantially reduced their landings of small fish which fell to 35 percent in 1992. Since than the proportion has increased somewhat, reaching nearly 45 percent in 1999, although the data do not include small fish discarded at sea. In some areas small swordfish are not a large problem, but large catches of small swordfish and the resulting discards can be a problem off Florida and has to be taken into account when using the landings data.[13]

Figure 6--U.S. longliners are active all along the Bahamian marine frontier off Florida and off the northern Bahamas. Triangles mark sets with 12 or more discards of juvenile swordfish over 1,000 hooks.

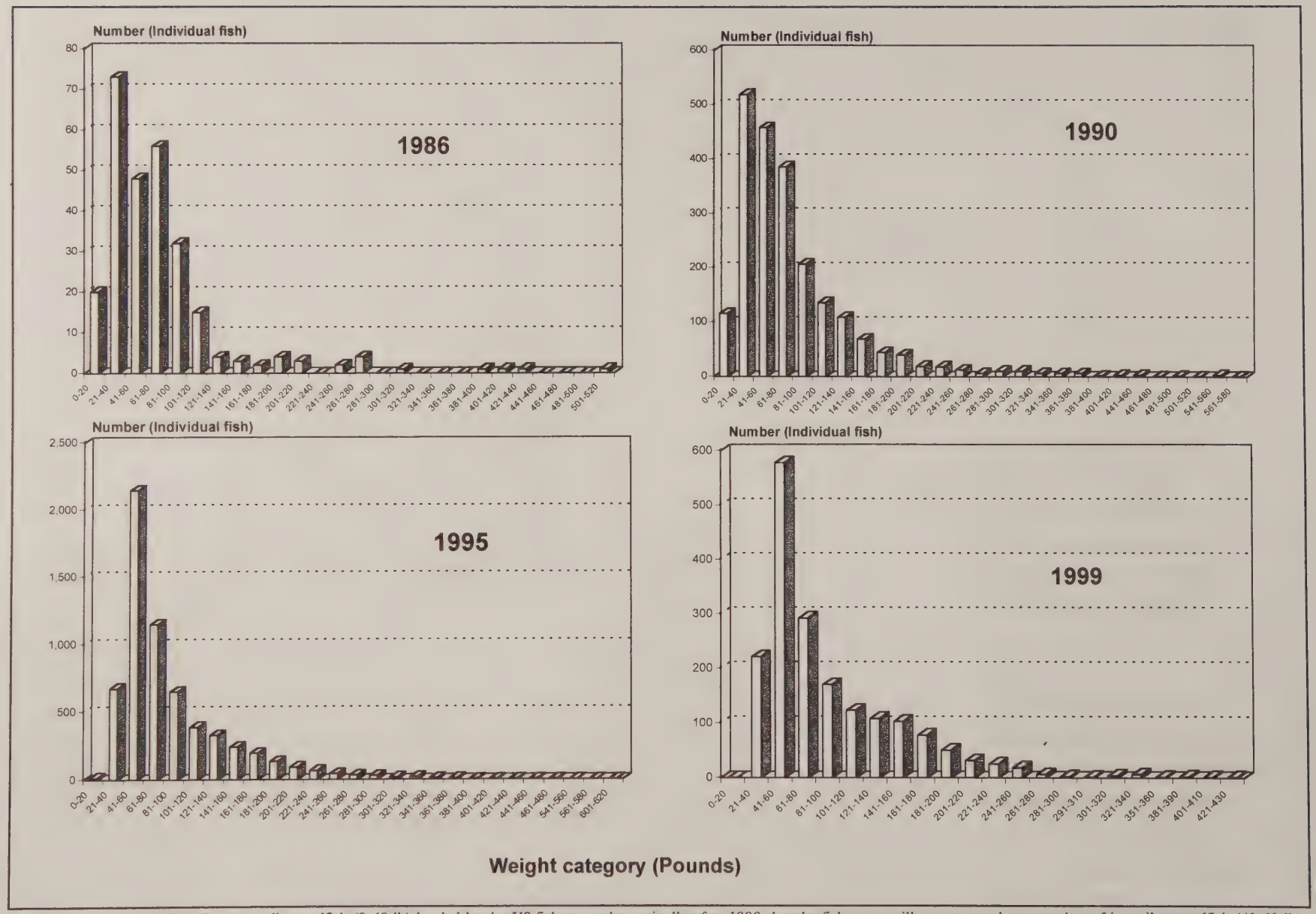

Figure 1.-- The proportion of very small swordfish (0-40 lb) landed by the US fishermen dramatically after 1990, but the fishermen still report very large catches of juvenile swordfish (41-60 lb).

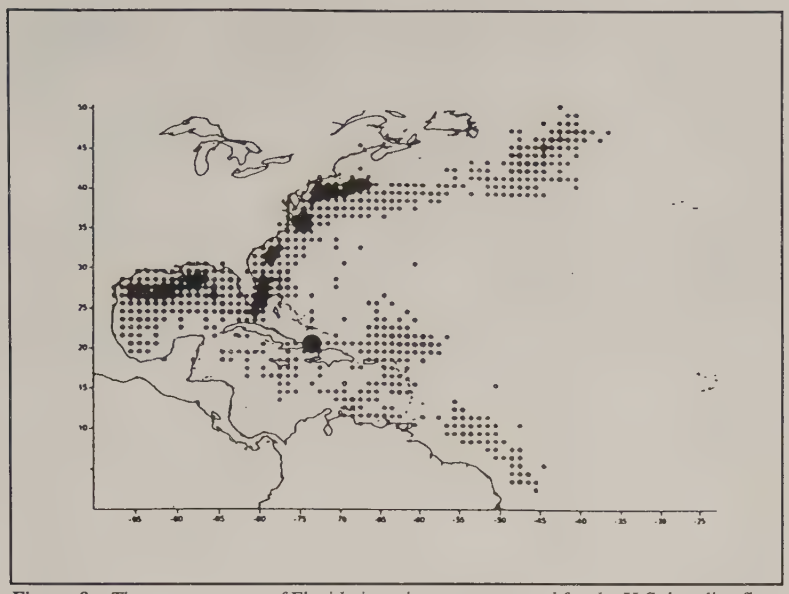

Figure 8.--The eastern coast of Florida is an important ground for the U.S. longline fleet. U.S. effort is shown here in 1990, but similar patterns are reported annually. Cramer

The NMFS Southeast Fisheries Science Center (F/SEC) keeps detailed records on the size distribution of the fish landed by U.S. fishermen (appendices A1-2 series). F/SEC also compiles log book data. The variable data shows that the east coast of Florida along the Bahamian marine border is an area where fishermen report substantial catches of juvenile swordfish. The presence of such large numbers of juvenile swordfish suggest that this may be a nursery area. Swordfish below the minimum size cannot be landed and have to be discarded. The actual rates vary from year to year and seasonally, but consistently large rates were noted in this area.[14] This led in 2000 to the U.S. National Marine Fisheries Service (NMFS) adopting regulations closing the longline fishery off the eastern coast of Florida and other areas. The Florida regulations will come into force February 1, 2001.[15]

Data from the Bahamas, as it is the case on many other island chapters in this report, are unavailable. As a result, the authors have had to look for other available data that may offer some insights.

The data shown here on the high take of juvenile swordfish represents data compiled by U.S. fishermen in the U.S. EEZ or on the highseas. The authors have no comparable data for Bahamian waters as there are currently no Bahamian longliners targeting swordfish are other oceanic pelagics. It is likely, however, that similar results would occur in the waters of the western and northern Bahamas beyond the shallow shelf.

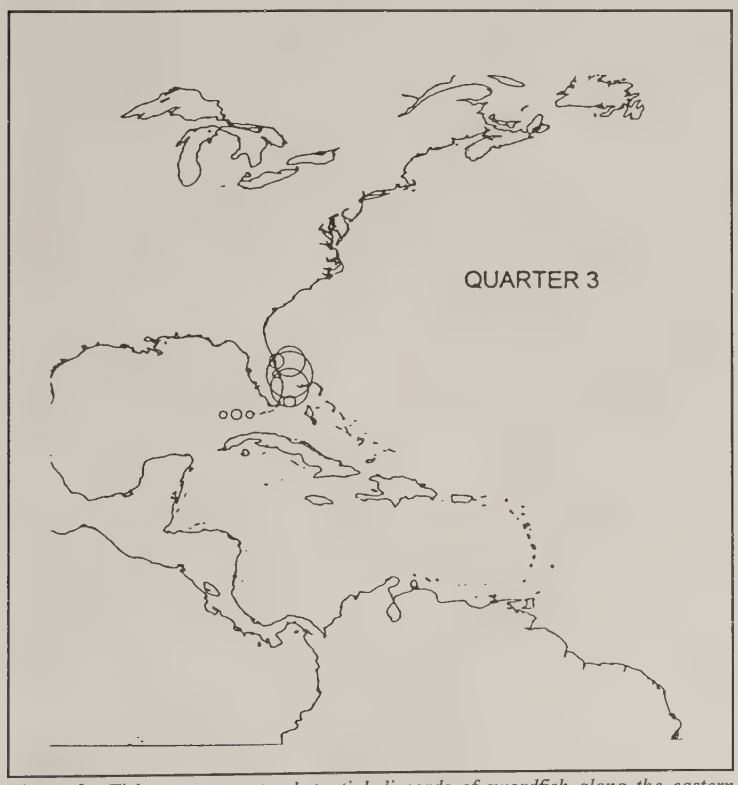

Figure 9.--Fishermen report substantial discards of swordfish along the eastern coast of Florida, west of the Bahamas. Patterns change seasonally, this graphic is the third quarter of 1993. Cramer

III. Grounds

A. Oceanography

The principal ocean current affecting the Bahamas is the Gulf Stream which runs north between the United States (Florida) and the Bahamas. The Gulf Stream is fed by the Caribbean outflow coming through the Florida Straits where it is met by the westerly flowing Antillian Current running along the northern coast of the Greater Antilles. (See Caribbean Overview.) The Gulf Stream and the associated eddies provide an ideal habitat for swordfish and other oceanic pelagics. Swordfish migrate north along the Gulf Stream toward the rich feeding grounds in the north Atlantic off New England and Canada.[16] At this time, however, only U.S. fishermen are targeting swordfish and other oceanic pelagics in the Gulf Stream with commercial longlines. Bahamian waters are noted for the clarity of the water which means that there is not a large nutrient load, resulting in relatively low productivity. FAO reports, however, that the potential yields compare favorably with estimates for comparable fishing areas throughout the Caribbean.[17]

B. Topography

While located north of Cuba outside the Caribbean Basin, the Bahamas are commonly considered a Caribbean island. The marine area encompassed by the Bahamas is the largest Exclusive Economic Zone (EEZ) of any Caribbean island, although the land area is less than Cuba or Hispaniola (Haiti/Dominican Republic). Many of the islands and cays are located on or near the Great Bahamas Bank. This Bank is a huge arc between the Bahamas and southern Florida to the west and eastern Cuba to the south with extremely shallow water. Large areas of the Great Bahamas Bank are only 4-7 meters (m) deep. Islands in the north are on the Little Bahamas Banks. These two banks are separated by the northwest and even deeper northeast Providence Channel. Several islands in the eastern Bahamas are located on their own bank or associated with the Turks and Caicos Banks.

C. Fishing grounds

Bahamian fishermen operate throughout the archipelago. The commercial fleet operates on a wide area of approximately 45,000 square miles of shallow water on the Little Bahamas Bank in the north and the Great Bahama Bank situated in the west, south, and central areas of the archipelago.[18] Officials report somewhat greater fishing activity around the northern islands.[19] There are various other shallow bank areas adjacent to the southeastern islands.

U.S. swordfish longliners tend to deploy their lines along the temperature gradients created by the Gulf Stream. The location of these sets varies, depending on the fluctuations and eddies of the Gulf Stream. Most of the best swordfish fishing in Bahamian waters, however, is believed to exist along the Gulf Stream in western Bahamian waters between Florida and the Bahamas. The waters between Florida and the Bahamas can be areas of intense longline activity, although the level of activity varies from year to year.[20] The large area of shallow water on Great Bahamas bank would not be appropriate for swordfish.

Photo 4.--This aerial view of Lee Stocking is a good example of the many small islands and cays that make of the Bahamian archipelago. NOAA

IV. Fleet

The Bahamas has one of the largest fishing fleets in the Caribbean, but made up primarily of artisanal and recreational boats.

Artisanal: Officials in 1990 reported an indeterminate number of small dinghies ranging in length from 3-6 meters. They are often deployed in conjunction with the larger commercial vessels.[21] Officials estimate that there are about 3,700 small artisanal fishing boats which have been registered. These are boats over 6.7 m; smaller boats do not have to register.[22] Officials report that the Government, in conjunction with FAO advisers, is drafting new regulations which would require all fishermen with boats over 3.5 m to register. Officials report that the small dinghies that work from mother boats are responsible for a substantial part of the Bahamian catch and thus the proper management of the fishery requires that they be registered.[23]

Commercial: Officials reported that 308 fishing permits were issued for commercial fishing in 1988. These vessels ranged in size from 6-27 meters. Some of the vessels, however, were not deployed in full-time fisheries.[24] Officials in 2000 reported that there were about 350-400 commercial fishing boats averaging 30.5-37 meters. They are mostly deployed in the lobster fishery. They can stay on the fishing grounds for up to 4 weeks.[25]

Recreational: The Bahamas has issued 6,000-7,000 permits for recreational boats. Many of the boats can carry 4-6 anglers.[26]

The Bahamas currently has no commercial longliners targeting tuna and swordfish. Fishermen acquired three longliners in the early 1990s and conducted limited operations with only minor success. As many as 10 small longliners may have been deployed. Small quantities of tuna and swordfish were exported to the United States (appendices E2a1 and E2b). Bahamian fishermen have also reported a small shark catch. The authors at this time have limited information on the type of vessels landing sharks. The longliner *Kostakis* was reportedly harvesting sharks in the early 1990s, but the authors have no information on the vessel. Bahamian officials report that other local vessels were targeting sharks. This is the first Bahamian pelagic longlining known to the authors.[27] The Bahamian Government in response to complaints from artisanal and recreational fishermen have since discouraged longlining. SCUBA diving is a well developed tourist activity in the Bahamas and shark dives are an important attraction. The concern over shark stocks were thus an important element in the developing of restrictive Bahamian longlining regulations.[28] As a result, there are no Bahamian longliners in 2000 and with existing regulations it not easy for fishermen to obtain commercial permits for such vessels. The Government has not banned longlining completely, but as a result of the political controversy generated by longliners in the mid-1990s, has adopted a restrictive policy which would look very critically at any such applications.[29]

Photo 5.--This Bahamian conch boat was photographed in 1980. Notice the small dinghies that the divers use. Charles Fuss

V. Shipyards

Bahamian shipyards do not build or service commercial longliners. Several yards work on recreational boats or small fishing boats, but major work on large vessels is usually contracted in nearby U.S. yards.

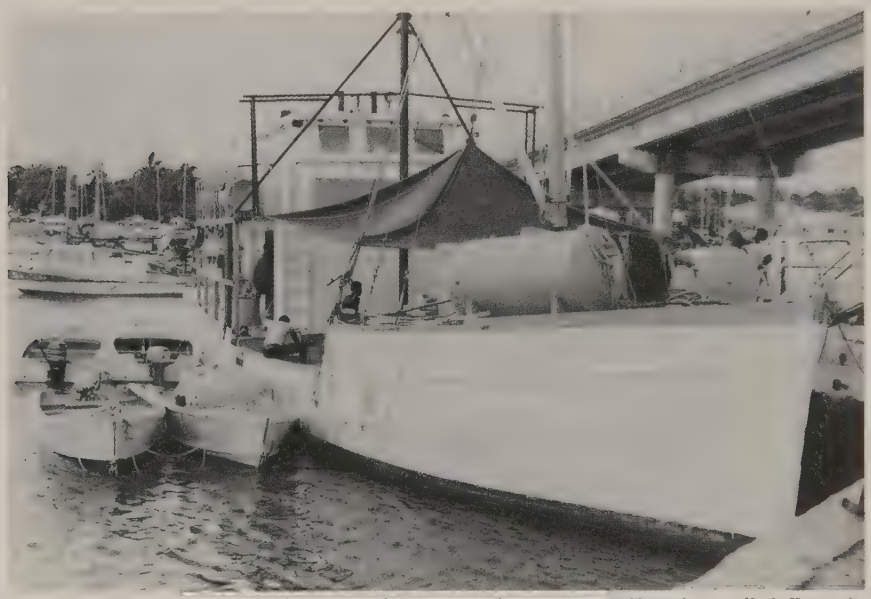

Photo 6.--This boat in the 1980s was used to target pelagic species. Note the small skiffs used to help deploy the net. Charles Fuss

VI. Fleet Operations and Gear

Bahamian fishermen conduct largely artisanal operations. These operations are in fact small-scale commercial fishing and generally referred to as commercial fishing by Bahamian officials. The recreational fishery is the largest and most important in the Caribbean.

A. Artisanal

Bahamian fishermen conduct trap, diving, line, and other fisheries. In some cases fishermen build artificial shelters to attract target species, mostly lobster. Some artisanal fishermen in the mid 1990s reported shark catches and have expressed an interest in initiating longline operations.[30]

B. Commercial

Bahamian fishermen do not conduct commercial longline operations. One press report, however, suggests a Bahamian fisherman fronting for foreign fishermen, during the early 1990s, obtained a commercial fishing license.[31] The U.S. Embassy in Nassau, however, reports no such permits were issued to commercial fishermen.[32] Some longlining was attempted in the early 1990s, resulting in small exports to the United States (appendix E2a1). The Government has since severely restricted longlining. (See "Government Policy".) The authors in 2000 have been able to find no indication that longline operations are being conducted in the Bahamas.

C. Recreational

Sport fishing is a popular activity and an important attraction in the Bahamas' large tourist industry. The recreational fishery is the largest and most developed in the Caribbean. Charter boat operators boast of over 50 world records being set in the Bahamas and that the islands are one of the premier destinations in the world for sports fishermen. A good example of the strength of the recreational fishery is that in the 23 Annual IGFA Fishing Contest, two records were set in the Bahamas (for dorado /dolphinfish and king mackerel). This was the only records set by any Caribbean islands.[33]

The extensive tourist infrastructure helps to draw American and European anglers. The Bahamas is particularly popular with American sport fishermen because the island is so close to Florida and easy for the fishermen to get to.

Billfish and wahoo are some of the major target species. Several different billfish are taken in the Bahamian fishery, but swordfish is not normally caught despite their presence along the Gulf Stream. Bonefish is also a popular target species.

Swordfish: Swordfish are not normally taken by the recreational fishermen.

Blue marlin: The fishermen troll for blue marlin, often using ballyhoo, mullet, artificial speed lures, and live baits. The best months are March through July.

Blue marlin tends to be the dominate billfish taken in the Bahamian tournaments.

White marlin: The fishermen also troll for white marlin using ballyhoo, strip baits, artificial speed lures, and live bait. The best months are December through February.

Sailfish: The fishermen deploy flying kites and trolls for sailfish, using live goggle-eyes, and ballyhoo. The best months are November through April.

Dorado: The fishermen troll for dorado using ballyhoo and split mullet. It is taken all year round.

Wahoo: The fishermen troll with live bait using ballyhoo and split mullet. It is taken all year round.

Kingfish: The fishermen both troll and set lines along the bottom using ballyhoo, live bait, and sardine. The best season is from September through April.

Demersal species: Many reeffish are also taken by the recreational fishermen, including snappers and groupers.

Photo 7.--Recreational fishing boats in the Bahamas are well equipped with the latest gear and equipment. Mark Farber

The Bahamas is a particularly popular site for sport fishing. The country's location close to Florida means that U.S. anglers can easily and inexpensively participate. As a result, there are more billfish and other recreational tournaments held in the Bahamas than in any of the Caribbean islands. Quite a variety of billfish recreational tournaments are held in the Bahamas (appendix D). Many focus on billfish and wahoo, but other species are involved as well. These tournaments are held at many different sites throughout the Bahamas.

Country-wide events: There is also the Bahamas Billfish Championship. This event is held in five different stages from various islands.

Abaco: A typical tournament is the North Abaco Championship at Walker's Cay. It was held May 2-7, 1999. Fishermen in 63 boats caught 74 billfish. The anglers released 65 of those fish (50 blue marlins, 14 whites, and 1 sailfish).[34] The Barta Blue Marine Classic is also held at Walkers Cay which attracted 70 boats in 1999.[35] The South Abaco Billfish Championship was held on April 18-23, 1999 and attracted 60 different boats and teams. During 4 days of fishing the participants caught 40 billfish, 31 blue marlin and 7 white marlin. The participants tagged and released 31 of the 40 fish.[36] The Bahamas Wahoo Championship is held at Treasure Cay on Abaco on January 26-29, 1999.[37]

Andros Island: Andros is best known for bonefish, but deep-sea sport fishing is also conducted from the island.

Berry Island: The Chub Cay Championship is held from Berry Island in May.[38]

Bimini: Bimini is best known for spectacular deep-sea sport fishing, especially billfish. Sport fishermen there bill the island as "The Big Game Fishing Capital of the World". The island's location enable the fishermen to fish in and along the Gulf Stream and the results can be spectacular. The Bimini Big Game Fishing Club, for example, organizes a small boat tournament in September. The Bacardi Rum Billfish Tournament is held on Bimini. The 20th tournament attracted 43 boats and 37 billfish were landed.[39] There is also the Bimini Rum Angling Tournament held in March.[40]

Eleuthera: The Harbour Island Championship is held on North Eleuthera. The 1999 tournament took place on June 20-25.[41]

Exuma: Deep-sea sport fishing as well as reef and fly

fishing is available on Exuma. Billfish strikes are frequent in Exuma Sound where water of over 1,800 m deep is close to the island. The major tournament is the annual July 4th Bonefish Tournament.

Lucaya: The Bahamas Wahoo Championship is held at the Lucaya Marina Village. The 1999 event was December 8-11.[42]

Marsh Harbour: The Boat Harbour Wahoo Championship was held at Marsh Harbour on June 8-11, 1999.[43]

Treasure Cay: The 16th International Treasure Cay Billfish Tournament was held June 20-25, 1999.[44]

Walker's Cay: The Barta Blue Marlin classic is held in April. The tournament in 1999 is in its fourth year. The tournament has helped promote the IGFA Junior Angler Program.[45]

One indication of just how extensive recreational fishing is in the Bahamas is the number of first and second place fish taken in the Bahamas by participants in the 23rd annual IGFA Fishing Contest. Fishermen took first or second place bonefish, horse-eye jacks, and oceanic white tip sharks from Berry Island, Grand Bahamas, Rum Cay, and Salvador . There were no contest winners reported from any of the Caribbean island countries.[46] There is no way to be sure, but the lack of winning reports may be more of a lack of entries and recreational fishing activity than the absence of trophy fish in the Caribbean. Several of the islands have very small recreational fisheries.[47]

The recreational fishermen report that billfish catches have been declining in recent fishermen. Many of the fishermen believe that commercial longlining is the primary cause of the decline. One local recreational fisherman estimates that it now on average takes 5 days of trolling to boat one blue marlin. The local fishermen report that swordfish are not taken in the country's sport fishery. Most of the sport fishing boats practice tag and release fishing.[48] Officials note that unless the fishermen has a commercial license, the recreational catch can not be sold.[49] This policy obviously helps to encourage tag and release fishing.

Photo 8.--Recreational fisherman can report spectacular catches in the Bahamas. This angler at Chub cay club landed a 165-kg marlin from the sport fishing boat "Hatt Box" Mark Farber

VII. Catch

The Bahamas reports no significant commercial swordfish, tuna, or billfish catch.[50] There is a small billfish catch reported by the recreational fishery.

Swordfish: Scattered imports of swordfish from the Bahamas have been reported by the United States. This suggests there is a small, irregular catch. Small shipments were reported in 1991 suggesting a catch of about 1 t and in 1993 suggesting a catch of about 0.5 t (appendix E2a1). These shipments are believed to be product caught by Bahamian fishermen who tried to introduce longliners in the early 1990s. (See "Fleet".) Some U.S. caught swordfish are known to be have been landed in the Bahamas during the 1980s (appendix B2b).

Tuna: The Bahamas does not report a significant tuna catch. Small shipments of yellowfin tuna were also reported to the United States in 1991 and 1993 (appendix E2b). This appear to have been product caught by Bahamian fishermen trying to introduce longliners in the early 1990s.

Billfish: The large Bahamian sports fleet must account for a sizeable number of billfish. The authors know of no estimate, however, on the quantity taken. ICCAT has no estimates on the Bahamian catch. The sports fishermen practice tag and release fishing so most of the fish are not retained.

Sharks: Artisanal fishermen reported a small shark catch of about 14 t in 1993.[51] Press reports indicate that one longliner was taking sharks.[52] Catch data reports that Bahamian shark catches of 37 t were reported in 1993, presumably in association with the efforts to initiate a longline fishery. Shark catches have since been minor, totaling only 3 t in 1997 (appendix C1). Officials report that shark is of little interest to Bahamian fishermen. One restaurant owner, however, specializes in sharks and operates a small boat to supply his restaurant.[53]

The pelagic longline fishery in the Bahamas has been very short lived.

1986: The first pelagic longliner was introduced in the Bahamas. Minor swordfish shipments were made to the United States for the first time (appendix E2a1).

1987-1990: No swordfish shipments were made to the United states (appendix E2a1).

1991: Minor swordfish shipments were made to the United States.

1992: The Bahamian FD estimates that 10 longliners were active in the Bahamas for as long as 5-6 years. The absence of significant shipments to the United States, however, suggests that they may have not been very successful because they were not landing substantial quantities of swordfish and tuna (appendix E2a1).[54]

1993: Some minor tuna and swordfish shipments are reported to the United States (appendices E2a1 and E2b). Artisanal and recreational fishermen protested the longline activity.[55] Government officials were hesitant to act, concerned that the news media has presented a one sided assessment of commercial longlining.[56] The Government eventually acceded to the popular outcry against longlining. Agriculture Minister Tennyson Wells was concerned that inaccurate press reporting had swayed public opinion. The Government in December 1993 passed a law establishing a Government policy discouraging longlining.[57]

1994: The Government announced that it would not renew the licenses of the approximately 10 Bahamian longline vessels. One of the vessels reportedly moved to the Turks and Caicos.[58] No swordfish or tuna shipments were made to the United States (appendices E2a1 and E2b).

1995-2000: Since 1994, no swordfish or tuna shipments have been made to the United States (appendices E2a1 and E2b).

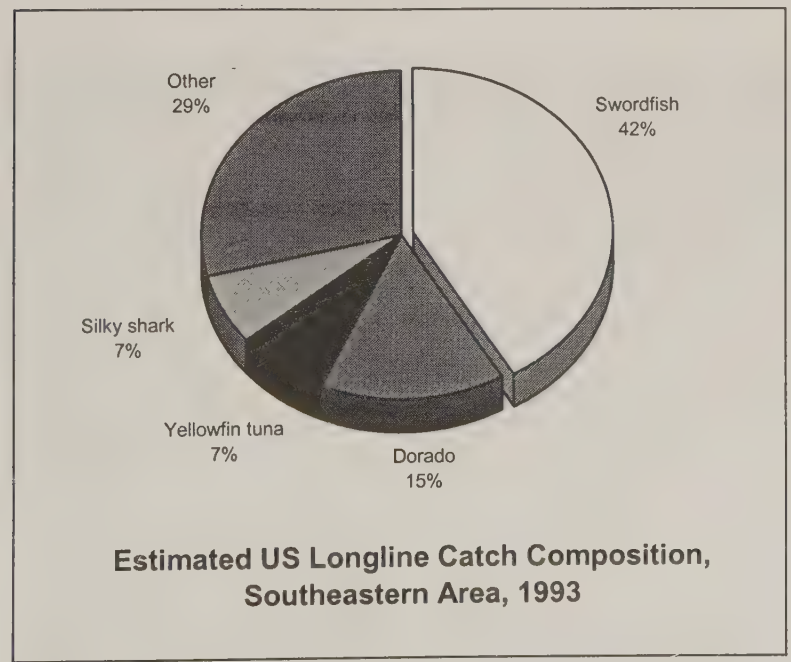

Figure 10.--The catch reported by U.S. longline fishermen west and north of the Bahamas is mostly swordfish, but dorado, yellowfin tuna, and silky shark are also taken with a variety of other species.

Photo 9.--The stern of an Asian longliner can be seen in this view of Nassau harbor during 1984. The authors are unsure why the longliner had called at Nassau. NOAA

VIII. Ports

The authors know of no ports where swordfish are being landed in the Bahamas. There are, however, a large number of marinas located throughout the Bahamas from which recreational fishing for billfish is conducted. The country's main commercial port is Nassau on New Providence. Large commercial fishing vessels have easy access to the Atlantic through the Northeast Providence Channel.

IX. Transshipments

Normally no swordfish or billfish is transhipped through Bahamian ports.[59] The authors have noted, however, occasional small amounts of swordfish transhipped (1988, 1989, and 1994) by U.S. fishermen. The largest quantity transhipped was the 31 t reported in 1988 (Caribbean, appendix B2b). Fishery officials report that transshipments are not currently permitted.[60]

While the authors know of no significant swordfish transshipments through Nassau or other Bahamian ports, foreign fishing vessels are known to have called in Nassau. Asian longliners, for example, were observed in Nassau during the mid-1980s. The authors at this time do not know why they were calling at Nassau. The vessels are known to have been active in the western Atlantic in the ocean areas north and east of the Bahamas Banks (appendix F1 and Caribbean Overview, appendices D2-D8).

Photo 10.--Marinas for sport fishermen and other recreational vessel owners are scattered around the Bahamas. Mark Farber

X. Processing and Products

No swordfish or billfish is processed in the Bahamas.[61] As swordfish is not taken in the local fishery, there is no product to process. Billfish is taken in the recreational fishery, but without a commercial license it cannot be landed--although exceptions can be made for trophies. Unlike several Caribbean islands where billfish is an important fishery commodity and widely consumed, billfish in the Bahamas is not targeted by the commercial fishermen. Sport fishing is widely seen as a major attraction for the important Bahamian tourist industry and thus the Government would be unlikely to authorize commercial fishing to supply processing plants and local markets.

XI. Companies

No Bahamian companies are known to handle swordfish. There are, however, several seafood companies. Many of the companies specialize in lobster. The principal companies processing and exporting seafood include: Island Seafoods (Nassau), Marsh Harbour (Abaco), Paradise Fisheries (Nassau), and Ronald's Service Center (Eleuthera) and Tropic Seafoods (Nassau).[62] The larger companies focus on exporting, primarily to the United States. Given the size of the Bahamian tourist industry and the popularity of seafood with Bahamians, there is also a strong domestic market for lobster and other high-quality seafood.

XII. Markets

A. Domestic

The authors have no information on domestic consumption of swordfish. It is believed to be small or non-existent. Small quantities may be imported for sale in tourist restaurants and hotels. Unlike many other Wider-Caribbean islands, billfish is not commonly consumed in the Bahamas.

B. Trade

1. Exports

The Bahamas does not export significant quantities of swordfish. Occasional shipments are reported to the United States, but have never exceeded 1 t (appendix E2a1). There have been no shipments at all since 1993. Some of the reported shipments have been U.S. transshipments and others have apparently been the small quantities taken when some fishermen tried to launch a longline fishery.

2. Imports

The Bahamas does not import any significant quantity of swordfish, however, tourist restaurants and hotels may import small quantities from the United States.

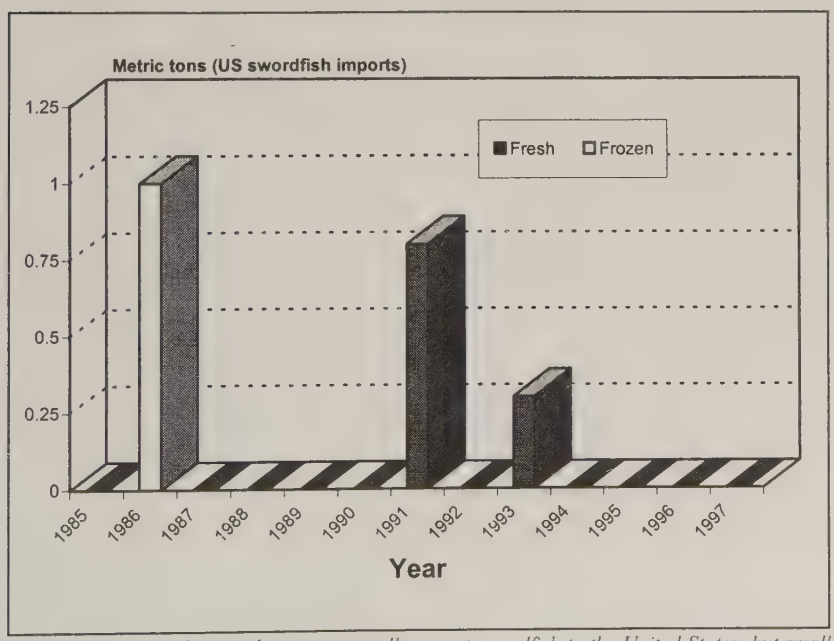

Figure 11.--The Bahamas does not normally export swordfish to the United States, but small shipments have occasionally been reported. Most of the fish are transshipped by U.S fishermen

XIII. Government Policy

The agency responsible for Bahamian fisheries was for years the Fisheries Department (FD) in the Ministry of Agriculture and Fisheries. As part of a reorganization in 1996, the FD was transferred to the Ministry of Commerce, Agriculture, and Industry.

A. Fisheries law

The principal Bahamian fisheries law is the Fishery Resources [Jurisdiction and Conversation] Act of 1977. The entire law has not been redrafted since, but occasional amendments have been made. Especially significant amendments were approved in 1996. Fishery officials believe that a major overall of the Act is needed to address changes in the country's fishing industry since 1977. The DF has suggested major changes in the provisions on fishing methods, foreign fishing, aquaculture, and other subjects and is vigorously promoting them within Government circles.[63]

B. Longline regulations

Bahamian officials in the early 1990s became concerned about the possible adverse impact of longlining, especially catching game fish species of considerable importance to the country's critical tourist industry--mainly billfish and shark. There was extensive U.S. longlining along the Bahamian western and northern border with the United States. At the time, as many as 10 Bahamian fishermen were attempting to initiate a longline fishery.[64] Until 1994, no law or regulation specifically prohibited longlining, however, no such permits had been issued to commercial fishermen. In the absence of any specific prohibition, several fishermen had initiated longline operations.

Artisanal and recreational fishermen were disturbed in the late 1980s and early 1990s when local fishermen began deploying longliners. Although the longline fishermen appear to have experienced little success, many local fishermen, especially the artisanal fishermen and recreational angler community, objected to the introduction of longline fishing to the Bahamas. Gear conflicts were reported with the artisanal fishermen. Longlining was the subject of extensive press coverage, mostly negative, and often emotional in the news media during 1993.

Protests, public demonstrations, and petition campaigns in 1993 lobbied the Bahamian Government to ban longlining. Local sports fishing, dive charters, and environmental groups as well as artisanal fishermen and marina operators actively protested, seeking a Government ban on longlining. Officials describe the outcry as in many ways an "environmental awakening" in the Bahamas with large numbers of persons for the first time openly expressing genuine concern for environmental issues.[65] Demonstrators disrupted the proceedings of the Supreme Court and the House of Assembly.[66] Press reports suggest artisanal fishermen in town meetings were "openly hostile" to Fisheries and Agriculture official Tennyson Wells.[67] Protests were held in late November and early December, 1993, in downtown Nassau. Protests in front of the House of Assembly lasted 3 days. Fishermen came in from outlying islands to protest. The Coalition Against Longlining and Ocean Watch Bahamas gathered signatures for a petition.[68] Over 8,000 people signed the petition. The Bahamas National Trust was active in the lobbying.[69] Groups like Re-Earth and the Bahamian National Trust (BNT) insisted that longlining was "too efficient," indiscriminate, and environmentally harmful. The BNT expressed particular concern with the affect of longlining on blue marlin stocks. Not only the BNT actively opposed longlining, but other groups and companies like Bimini Undersea Adventures, Abaco fishermen, dive operators, and various environmental groups spoke, demanding Government action.[70] Abaco fishermen even threatened to form a militia.[71] One company (Dive, Dive, Dive) providing diving experiences for tourists complained about observing a large number of Caribbean reef sharks which had become entangled in longline gear deployed by the commercial fishing vessel *Kostakis*.[72]

The Agriculture and Fisheries Minister was concerned about what he described as "disinformation" and that the "side" of the commercial fishermen was not being heard in the national debate over longlining.[73] Prime Minister Ingraham complained that there were political agitators and "strange bedfellows" among the frequently noisy protestors.[74] Wells in particular was sharply criticized by the protest groups in the media. Government officials in 1993, however, were reportedly assessing requests from artisanal fishermen to authorize longline gear.[75] One conservationist group reported that a Bahamian-United States partnership also requested authorization for longline operations.[76]

Bahamian officials by late 1993 were ready to restrict longlining, but hesitated to ban it outright.[77] The issue escalated to the highest level of Bahamian politics. Prime Minister Hubert Ingraham told protestors, "Longline fishing is a no, no." He said that

message would be clear to everyone "at the end of the day." Ingraham told fishermen, "You have a very strong point of view about longline fishing and about conserving and preserving the resources, particularly the fishing resources and other resources of the Bahamas. .... We are of one accord. Our purpose and our objective are the same."[78] Senator Barry Malcolm assured demonstrators that longline fishing would come to an end when a bill to amend the Fisheries Act was passed. The bill provided for fines of $50,000 to $100,000 and confiscation of offending gear.[79]

The House of Assembly approved a bill on December 3, 1994, permitting the Government to regulate longline fishing. The concerns expressed in Parliament was: 1) to protect the livelihood of Bahamian fishermen who employ "less intensive methods"; 2) preserve the rights of Bahamian fishermen harvesting fish for food and recreation; 3) promote the tourist industry; and 4) conserve marine species. The bill disappointed some of the recreational and artisanal fishermen who had lobbied for a total ban. A proposed absolute ban, however, was rejected.[80] While not the outright prohibition the protestors desired, very stringent conditions were attached to any future longlining. The U.S. Embassy in Nassau reported that it was highly unlikely that the Government would ever issue such permits.[81] Longlines were defined as lines longer than 20 yards with more than 10 hooks extending more than 20 yards from the point where the line is set. Permission to use longlines must be obtained from the Governor General and the applicant must show that his longline will not "endanger elements essential to sustainable fishery development" and will not "prejudice" the development and expansion of ecotourism. Violations of the regulations can result in fines ranging from $50,000-$100,000.[82] Government officials reported that in 1995 they turned down one applicant.[83]

The Government continues to severely restrict both longlining and trawling to protect the available resource.[84] The Bahamas is one of the few countries that has such a restrictive policy on longlining and the only one in the Caribbean.

Government officials in 2000 stress that longlining is not absolutely banned. Officials report that the Government policy enforced by the DF is to discourage longlining. There are no permits currently issued for longlining. The Government would not reject an application outright from a Bahamian fisherman to longline, but the DF would subject it to very critical scrutiny. Officials report that they have not received any such applications for several years and that none are pending.[85]

C. Recreational regulations

Sport fishing groups in the Bahamas have played an important role in helping to regulate the recreational fishery and conserve stocks. Many tournaments set minimum sizes, usually weights, and promoted tag and release fishing. The Bahamas Billfish Tournament, the most important in the Bahamas, in 1990, changed the minimum sizes to lengths in an effort to be consistent with the U.S. Fisheries Management Plan for Atlantic Billfish. Government policies prohibiting the sale of the recreational catch, unless the fisherman also has a commercial license. Recreational fishermen can land their catch for their own personal consumption. They can not, however, market it. This has been an important factor in promoting tag and release fishing. Officials point out that billfish have never been sold in great quantities in the Bahamas and there is no great demand for these species. Bahamian consumers prefer white meat demersal species like snapper and grouper.[86]

D. Limits

The United Kingdom declared a 3-mile Territorial Sea in 1878 for the Bahamas and other colonial dependencies.[87] The independent Bahamian Government declared a 200-mile Fishing Zone in 1977.[88] The Bahamas signed the Law of the sea Convention in 1982 and ratified it in 1983.

E. Licenses

Bahamian commercial fishermen must register their vessel with the Port Department which can cost $50-300, depending on the size of the vessel. A business license is required from the Ministry of Finance, the cost of which depends on the annual income of the fisherman. Once these two documents are obtained, the DF then issues a commercial fishing license. Licenses do not specify species and can be used to harvest any species. The commercial fishing "license" costs $10 annually. Actually the $10 is probably better described as a vessel registration fee. The fishery is open to all Bahamians and there is no restriction on species or quantities landed.[89]

Licenses are required for recreational fishing. Tourists can purchase sport fishing licenses upon clearing Customs and Immigration.

The Government in the early 1990s required countries whose fishermen desire to fish in Bahamian waters negotiate a bilateral fishing agreement. No such

agreements have to date been negotiated. All commercial fishing vessels must be wholly owned by Bahamian citizens resident in the Bahamas.[90] Foreign longline fishermen transitting Bahamian waters are required to store their gear "out of sight". Government officials indicate that longline gear should be dismantled and stowed below deck or where it is not readily accessible.[91] Officials in 2000 report that no foreign fishing is allowed in the Bahamas.[92]

XIV. Research

The authors know of no Bahamian research on swordfish and billfish. There is some work with related topics.

Fisheries Department: The Bahamian Fisheries Department compiles data for the sport fishing tournaments, although the authors know of no research study utilizing that data. Bahamian sport fishermen commonly cooperate with foreign, mostly U.S. researchers.

National Trust: The National Trust has supported turtle research conducted by the Center for Sea Turtle Research at the University of Florida.[93]

International organizations and foreign research institutes have provided some assistance with data collection needed for research and management.

CARICOM: The Caribbean Community's (CARICOM) Fisheries Resource Assessment and Management Program (CFRAMP) initiated a biological data collection program for large pelagics in 1995. The program was extended to the Bahamas in 1996.[94]

Florida Institute of Technology (FIT): The FIT has performed several fisheries and oceanographic research studies under contract with the Bahamian Government. The work has not, however, focused on highly migratory species.[95]

National Marine Fisheries Service (NMFS): NMFS researchers monitor selected recreational tournaments in the Bahamas and elsewhere in the Caribbean. The biologists collect data on fishing effort; number of billfish (by species) hooked, lost, boated, released and tagged; length, weight, and sex of boated billfish; types of bait used as well as various environmental data associated with each fishing trip. Information collected from these surveys is used to monitor trends in the recreational billfish fishery. Biological samples are also collected for age and growth determination and genetic studies. The data is shared with the Bahamian Department of Fisheries.

SCDNR: The South Carolina Department of Natural Resources (SCDNR) has been compiling data on billfish catches. Blue marlin and sailfish are the most important billfish, but swordfish are also reported. Researchers at SCDNR are attempting to compare the catch rates by area with associated weather patterns.[96] The SCDNR collects data from an area only slightly north of the Bahamas. The South Carolina researchers are not working with the Bahamians, but as the swordfish off the Bahamas and the United States is a

Photo 11. NMFS and other researchers use the billfish tournament to collect information [illegible] studying the stomach contents. Mark Farber

Photo 12.--NOAA research vessels have been deployed in a variety of cooperative research programs with the Bahamas. NOAA

shared resource, the work of the South Carolina researchers is providing valuable information needed to better understand swordfish behavior and migratory patterns in the Caribbean and Atlantic off the Bahamas and southeastern United States.

UF: The Center for Sea Turtle Research at the University of Florida (UF) conducts an annual research expedition at the Union Creek Marine Turtle Station on Great Inagua--an approximately 20 square mile area within a national park where green turtles, loggerheads, and hawksbills can be studied in their feeding grounds. Research has focused on nutritional ecology, growth rate studies, and tag applications and application technologies.[97]

UM: University of Miami (UM) researchers have done extensive work on swordfish, tuna, billfish and related species. This has included work in the Florida Straits between the Bahamas and the United States.[98]

Other: Several U.S. research institutes, state agencies, and university groups are working on swordfish. This work is not being conducted in cooperation with Bahamian researchers who have shown little interest in the species because their fishermen do not target it. The Bahamas has only a limited domestic research capability and understandably focus it on lobster and other species targeted by the local commercial and artisanal fishermen. As the swordfish off the Bahamas and the United States is a shared resource, the work of the U.S. researchers, especially those in Florida and the other southeastern states, is providing valuable information needed to better understand swordfish behavior off the Bahamas and other Caribbean islands.

XV. Bycatch

There is no directed Bahamian swordfish fishery and thus no bycatch. Data on potential bycatch levels for the Bahamas, as the Caribbean islands, is very limited. Some idea of bycatch trends east of Florida and other southeastern states are available by assessing the data available on the U.S. longline fleet working the Gulf Stream (Caribbean Overview, appendix G1c3).[99] While this data does not pertain specifically to Bahamian waters or varying fish strategies which could be used by Bahamian fishermen, it does provide useful benchmark data of what bycatch trends could be like in the western Bahamas along the Gulf stream.

A. Tuna

Observers along the U.S. Southeastern coast in 1993 reported that tuna, mostly yellowfin, constituted 12 percent of their catch (appendix C3a2). U.S. fishermen along Florida's eastern coast reported tuna landings ot 19-25 percent in 1998-99, mostly bigeye and yellowfin (Caribbean Overview, appendix G1c3b). The tuna, while not the primary target species, was a highly desirable bycatch species because of the strong market for fresh product. These results are an indicator of what Bahamian fishermen might experience in their western and northern waters beyond the shallow banks that the artisanal fishermen currently target.

B. Billfish

Observers along the U.S. Southeastern coast in 1993 reported that billfish were about 7 percent of longline catch (appendix C3a2). The primary species was sailfish. This substantial billfish bycatch is one of the reasons that Bahamian authorities decided to strictly limit longlining so as to reserve the billfish for the sport fishermen. The potential revenue from sport fishing is many times what the billfish would sell for in the local market. There is no published data on billfish catches in Bahamian waters. A substantial part of the catch is taken by American sport fishermen. Data from the tournaments is collected by the NMFS Southeastern Fisheries Science Center. The data is included in the U.S. billfish catch, but the separate data indicating the quantity of billfish taken in Bahamian waters has not been published.[100]

Photo 13.--Bahamian fisherman do not deploy longlines so there is no billfish bycatch. Billfish like this spearfish are taken by recreational fisherman. Mark Farber

C. Shark

Shark is of some importance to the Bermuda tourist industry. Diving is an important tourist attraction in the Bahamas and shark dives are among the most popular. There was some longlining for shark in the 1990s and concern over this species was an important factor in the Government's decision to restrict longlining.[101] Observers aboard U.S. longliners report a substantial and highly varied shark bycatch. Nearly 20 percent of the longline catch was shark (appendix C3a2). About 20 species were taken, but the most important were silky (*Carcharhinus falciformis*) and dusky (*C. obscurus*). In other areas blue sharks (*Prionace glauca*) were more important, but they are a relatively minor species off the southeastern coast. As stated above, the species that might actually be taken in Bahamian waters could be different, but the species taken by U.S. fishermen off the southeastern coast are probably a good indicator of what sharks might be taken in the northern and western Bahamas.

D. Other fish

The principal other fish caught in quantity by U.S. fishermen off the northeastern coast is dorado (*Coryphaenidae*). Dorado constituted nearly 15 percent of the U.S. longline catch (appendix C3a2). Other species taken in small quantities included escolar, lancetfish, oilfish, wahoo, and several others.

E. Turtles

The primary turtles found in Bahamian waters are greens, hawksbills, and loggerheads. All three species have been harvested, although a ban in 1986 ended the exploitation of hawksbills (appendix C2a). The greatest quantity harvested in the 1980s was loggerheads. Bahamian officials have reported a turtle harvest during the 1990s varying from 12 t (1990) to 2 t (1994-95). The 1997 harvest was 3 t (appendix C2b). A turtle farm was established on Great Iguana Island. It was a pilot ranch hatching and rearing various species of turtles in an area of enclosed turtle grass pasture.[102] While sea turtles are a traditional Bahamian dish, it represented more of an occasional delicacy than a regular staple.[103]

The Bahamas enforced minimum size restrictions during for harvesting of hawksbill (17 inches) and green (17 inches) turtles.[104] Taking hawksbills of any size were banned in 1986 and minimum sizes set for greens (24 inches) and loggerheads (30 inches). Taking individuals under those sizes were offenses under the marine Products (Fisheries) Rules. It was unlawful to take turtles on the beach or to sell or possess eggs.[105] The turtle harvest was also closed seasonally (April 1 through July 31).[106]

As the Bahamas does not permit longlining, there is currently no turtle bycatch resulting from the swordfish/tuna longline fishery. A substantial part of the Bahamian fishery uses traps and diving to catch lobster. As a result, interactions with turtles are limited. Some idea of the potential interactions with

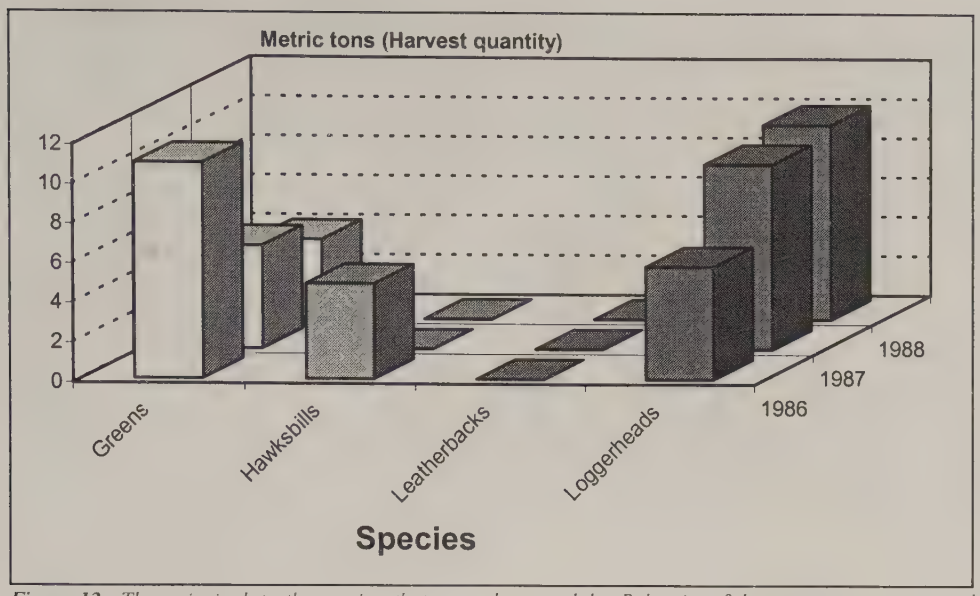

Figure 12.--The principal turtle species that were harvested by Bahamian fisherman were greens and loggerheads.

pelagic longlining can be obtained by assessing U.S. observer data. U.S. longline fishermen operating along the Gulf Stream off eastern Florida do report interactions. This would probably be the same area Bahamian longliners would target. Interaction rates have varied from no turtles in the 39 observed sets ("hauls") in 1992 to 6 turtles in 37 observed sets in 1995, or one turtle every 6 sets (Caribbean Overview, appendix G1b2). More commonly the experience have been 1 turtle in every 25-40 sets. Most of the interactions are leatherbacks and loggerheads (Caribbean Overview, appendix G5a).[107] The level of interactions seems lower than the Caribbean, but higher than some other areas such as Hawaii (Caribbean Overview, appendix G5g).[108]

Various U.S. agencies have been involved with turtle work on the Bahamas. Center for Sea Turtle Research at the University of Florida researchers, for example, have worked on green turtles.[109] NMFS has prosecuted two Miami fishermen for attempting to being in hawksbill shell and meat. One fisherman in 1991 pleaded guilty and the other was found guilty in a jury trial.[110]

F. Marine mammals

The authors have little data on potential marine mammal interactions if a longline fishery was initiated in the Bahamas. Data from U.S. observers operating along the southeastern coast show some interactions with pilot whales (Caribbean Overview, appendix G1b2).[111] Some information is available on the marine mammal populations in the northern Bahamas. U.S. longline fishermen fish up to the western and northern marine boundary with the Bahamas. Thus if the Bahamas were to launch a longline operation, the northern Bahamas would be one of the grounds where longliners would be deployed. An unexplained occurrence in March 2000 resulted in 13 marine mammal stranding events. The species involved included different species of beaked whales, unidentified rorqual whales, spotted dolphins, and minke whales. This provides an indicator of the marine mammal present in Bahamas waters. Pilot whales, a species known to be involved in longline interaction, were not mentioned.[112]

G. Seabirds

Available information suggests that about 15 species of seabirds nest in the Bahamian Islands and nearby Turks and Caicos Islands (appendix C4).[113] Some work has been done on seabirds in the Bahamas. The authors have noted research on shearwaters. A species which has attracted considerable attention is the Audubon's Shearwater (*Puffinus iherminieri*) which nests in cays around Exuma as well as Puerto Rico and other locations in the Caribbean. Population declines have been documented in Puerto Rico and the species is extinct as a breeder on Bermuda. There may be as few as 5,000 pairs of this species and subspecies may be nearing extinction. The species within the Caribbean area appears to be the most abundant in the Bahamas.[114] While research has been done on the natural history and population of seabirds, little or no work is known to address the topic of fishery interactions.

The authors were unable to find information on seabird interactions in the Bahamas or potential seabird interactions if a longline fishery was initiated in the Bahamas. Data from U.S. observers on longliners operating along the U.S. southeastern coast show no seabird interactions, but limited interactions with gulls off the northeastern coast (Caribbean Overview, appendix G1b1).

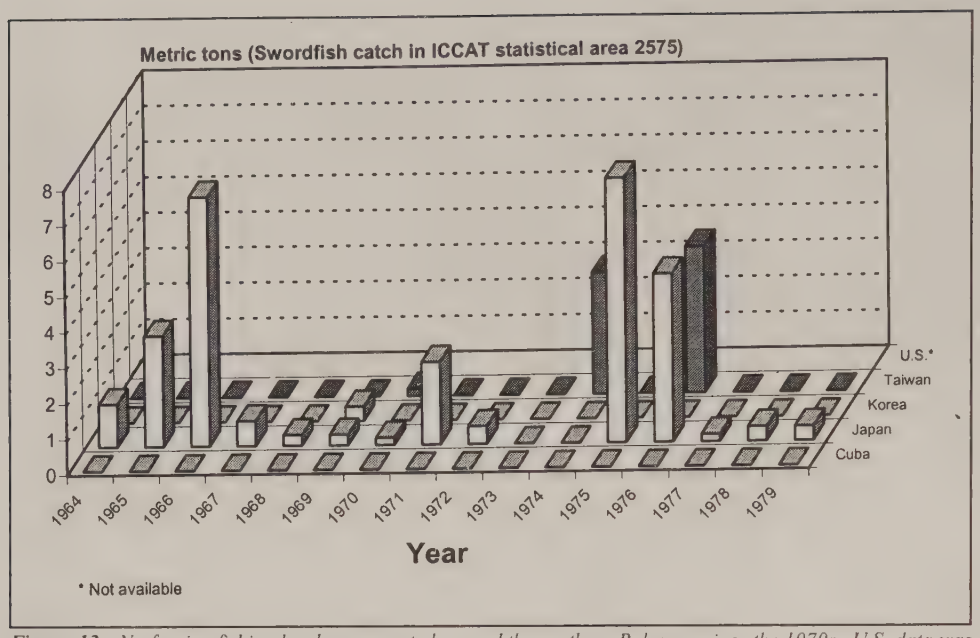

Figure 13.--No foreign fishing has been reported around the northern Bahamas since the 1970s. U.S. data was unavailable.

XVI. International

A. Multilateral

Two international organizations have been involved in Bahamian fisheries.

FAO: The Inter-American Development Bank (IDB) contracted a private consultant (Fisheries Development Ltd.) in 1980 to prepare a fisheries development program for the outer islands.

ICCAT: The Bahamas is not a member of the International Commission for the Conservation of Atlantic Tunas (ICCAT), but has expressed interest in possible membership.[115] The Bahamas has decided to severely limit efforts by fishermen to develop a longline fishery. The absence of a commercial longline fishery suggests that the country will probably not join ICCAT in the near future as most members, as well as ICCAT's programs, are primarily concerned with commercial fisheries. While Barbados currently has no significant commercial fishery for swordfish, the country does have a substantial interest in billfish and other species of interest to sports fishermen. Tourism is the principal Bahamian industry and sports fishing is an important attraction for the industry. ICCAT's work on sport species such as billfish means that officials should cooperate closely with ICCAT's work on these species.

B. Bilateral

Data for foreign fishing in the Bahamas is complicated because of the large area covered by the Bahamian archipelago. Bahamian waters include parts of several ICCAT 5° statistical squares. (The ICCAT statistical squares are defined in the north west Atlantic by the latitude and longitude of the southeastern corner. Thus 2575 would mean the 5° square with 25°N and 75°W as the south eastern corner. The overall fishing patterns of distant-water fleets will be discussed in the Caribbean Overview. Foreign operations in specific ICCAT statistical squares, because of the overlapping political jurisdictions, will be discussed as follows:

2570 and 2575: These two ICCAT squares will be used for the discussion below.

2070: Will be discussed in the Turks and Caicos chapter.

2075: Will be discussed in the Cuban chapter.

The Bahamas has no bilateral fishery agreements affecting swordfish. The Government currently does not authorize any foreign commercial fishing. Officials report that they have received formal and informal applications from foreign companies seeking longline permits. All such applications have been rejected.[116]

Cuba: Neighboring Cuba has developed the Caribbean's largest commercial longline fleet. The fleet, however, was deployed primarily off West Africa. There has been no Cuban longlining off the northern Bahamas (ICCAT statistical square 2570) or offshore areas to the east (ICCAT square 2570) (appendix F1-2). There has also been virtually no Cuban fishing to the south (ICCAT squares 2075 and 2970). Some catches were reported in ICCAT square 2075 during 1986, but this Cuban fishing could have been in the Cuban coastal areas of these ICCAT statistical squares (Caribbean Overview, appendix D3).

Japan: Japan has been the principal Asian countries deploying longliners in and around the Bahamas. Operations around the Bahamas have been very limited during the 1990s.[117] The Japanese began fishing

around the northern Bahamas (ICCAT square 2570) and the offshore Atlantic to the east during 1963-64 (appendix F 1-2). Fishing around the northern Bahamas was last reported in 1979. Modest swordfish catches were reported in most years, but catches of 7 t were reported in 1966 and 1975. Fishing from 1964-71 was mostly in the second quarter while beginning in 1975, operations were shifted to the first quarter (appendix F2). The Japanese have occasionally been active in the offshore area to the east of the northern Bahamas (ICCAT square 2570) even after terminating operations around the Bahamas itself. Catches have been reported as late as 1996. Operations have primarily been reported in the second quarter, but the pattern was more varied than in the area to the west (appendix F1)[118]

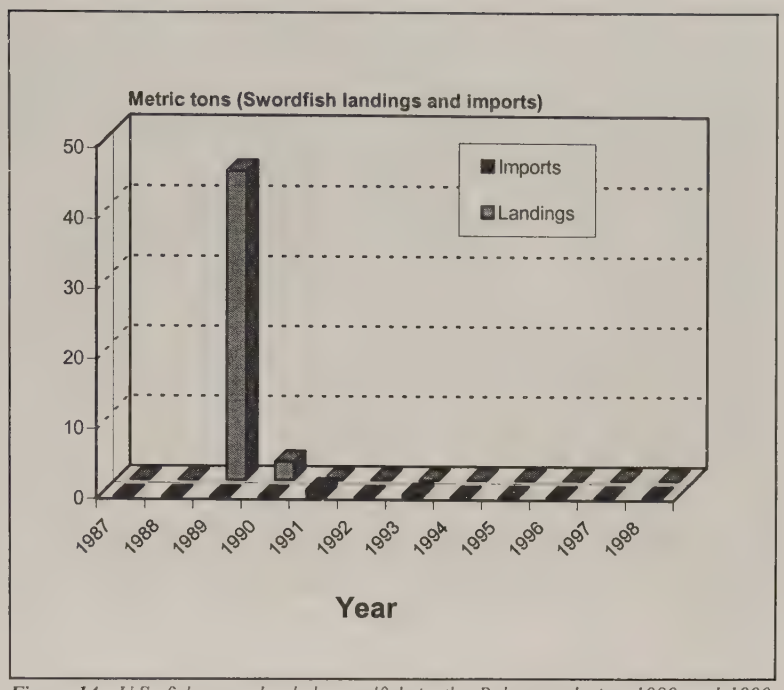

Figure 14.--U.S. fishermen landed swordfish in the Bahamas during 1989 and 1990. Only small quantities of those landings were shipped to the United States.

Korea: Korean operated a substantial longline fleet in the Atlantic during the 1960s, 70s, and 80s. Fishing in and around the Bahamas, however, was limited (appendix F1-2).[119]

Spain: There is no Spanish longlining in Bahamian waters. The large Spanish fleet has moved into the central Atlantic, but does not work in the Caribbean.[120]

Taiwan: Taiwan, like the Japanese, initiated Caribbean-area longline operations in the 1960s. The primary Taiwan activity has been to the north of the Caribbean, as far as Bermuda, where they have targeted albacore to supply Puerto Rican canneries packing "white meat" tuna.[121] Many of the vessels have operated out of St. Maarten.[122] Available evidence suggests that Taiwan longliners are not extensively fishing Caribbean waters, but are using Caribbean ports to transship their catch and maintain their fleet. Representatives of the Nichirei Carib Corporation who operate the Taiwan fleet have told British officials that access to British Virgin Island and Anguillan waters would be desirable, but not essential for their operations.[123] They have fished seasonally in Turks and Caicos waters to the east of the Bahamas.[124] Fishing around the northern Bahamas and areas to the east have been very limited and mostly reported in the 1970s. Taiwan operations were limited to the first or second quarter in each year (appendix F1-2).[125]

United States: The United States began developing a longline fleet targeting yellowfin tuna in the Gulf of Mexico. Beginning in the mid-1980s, U.S. longline fishermen began targeting swordfish after commercial stocks were encountered off the Florida Atlantic coast adjacent to the Bahamas.[126] U.S. fishermen fish continue extensively off Florida, although their main grounds are to the north off the U.S. northeast and mid-Atlantic cost (figures 6 and 7). The U.S. longline fishermen operating off Florida occasionally enter Bahamian waters. Most of the vessels operating illegally in Bahamian waters, however, are recreational fishermen and commercial fishermen targeting other species. The fishermen involved primarily target lobster, snapper, and other reef fish. (See "Enforcement.") The best fishing for swordfish is within U.S. waters and the extreme westward perimeter of the Bahamian EEZ. Most of the U.S. effort is associated with the Gulf Stream west and north of Bahamian waters. As a result the U.S. longliners have little incentive to enter Bahamian waters. A few U.S. longliners in some years focus on Windward Passage between Cuba and Haiti and south of the easterly Bahamian island of Great Inagua.[127]

C. Foreign aid

Upon achieving independence in 1973, Bahamian officials contacted several donors concerning assistance in modernizing the fishing industry. The major donors providing foreign assistance to the Bahamas has been the FAO/UNDP and the IDB.

Canada: Canada financed a $3.1 million IDB project in 1980.[128] Canada directed most of its available aid funds to other Caribbean islands because of the relatively high income levels on the Bahamas.

FAO: Bahamian fisheries benefitted from almost

Photo 14.--FAO provided a small fishing boat, the "Guanahani", for use as a training vessel. Charles Fuss

continuous FAO/UNDP assistance from 1972 through 1984. The projects included exploratory fishing for deepwater snapper and grouper (1972-76), training (1978-82), shallow water resource assessment (1983-84), and operating a landing facility at Potters Cay, New Providence (1982-84).[129] Many of the findings and recommendations were incorporated into a 5-year development plan launched in 1978.

IDB: The Bahamian Government sought assistance from the Inter-American Development Bank (IDB) to carry out several of the recommendations made by the FAO.[130] The IDB provided financial assistance in 1979 for two sub-projects involving a landing site at New Providence ($2.1 million) and financing for the Bahamas Development Bank (BDB) for a fisheries credit program providing loans to the fishing industry. Loan funds were used for a variety of small projects such for small-scale fishermen.[131] The IDB has also assisted cooperatives.[132] Some of the IDB projects were funded by Canada and Venezuela.

Taiwan: The Taiwan Government has supported some work on lobster culture.[133]

XVII. Enforcement

Fisheries enforcement is a major problem for Bahamian officials. The small Royal Bahamian Defense Force (RBDF) is responsible for marine enforcement. The RBDF has an extensive EEZ to patrol and limited resources for fisheries enforcement. The RBDF faces problems posed by several foreign fishermen. The primary problem in the northwest are U.S. longliners and trappers. The problem in the south is posed mostly by Cuban, Dominican, and Honduran fishermen. Bahamian officials also believe that recreational fishermen, mostly from the United States, sometimes exceed sport fishing bag limits in violation of Bahamian law.[134] Other observers report poaching by foreign longliners, primarily fishermen from Canada and the United States.[135] Bahamian officials report that staff and funding limitations have made it difficult to curtail illegal activities.[136]

Officials report that from 1986-92 they seized 63 foreign commercial fishing vessels. This number, however, is small in relation to the number of sightings reported by Bahamian fishermen.[137] The foreign fishermen target several different species. The trap and dive fishermen catch mostly lobster. The longline fishermen catch tuna and swordfish, although details on the species taken are unavailable.

The Royal Bahamian Defense Force (RBDF) has reported enforcement incidents with several neighboring countries. NMFS does not have a complete inventory and some of the source do not specify the target species or type of vessel.

Canada: Press reports charge that some Canadian fishermen were longlining in the Bahamas without obtaining a license.[138]

Cuba: Numerous incidents have been reported with Cuban fishing vessels, including one 1984 incident in which a Bahamian Defense Force patrol boat was strafed by Cuban Air Force MIGs. Another violent incident occurred in 1994 when Cuban fishermen assaulted a RBDF boarding team and one of the fishermen was killed.[139] Observers continue to report the occasional presence of Cuban fishing vessels on southern Bahamian grounds. The boats involved appear to be small craft, perhaps about 6-m long involved in line fishing. The Cuban boats often have minimal equipment, even lacking radios. They do not appear to be longliners and certainly none of Cuba's large commercial longliners.[140] Officials report that they have had problems in the past with Cuban lobster

boats, but not recently.[141]

Dominican Republic: Bahamian newspapers report numerous and continuing incidents with Dominican fishing vessels. Many are small artisanal craft, but some are larger vessels with crews of about 20. The Dominican fishermen are primarily targeting demersal resources. Fishery officials report that Dominicans are a special problem, "Whatever moves they catch."[142]

Honduras: The Bahamas has reported incidents with Honduran vessels. A violent incident was reported in 1994 when Honduran fishermen "kidnapped" RBDF marines.[143] Fishery officials report continuing incidents with Honduran fishermen.[144]

United States: The Bahamian Government in the mid-1980s licensed several U.S. vessels to conduct exploratory fishing in Bahamian waters. Some of the U.S. fishermen fished for stone crabs while others set demersal longlines for snappers and groupers--mostly in water deeper than 30 meters. At least one of these fishermen were quite successful, but no Bahamian fishermen were able to carry on the fishery after the Americans departed.[145] Bahamian press reports charge that some U.S. fishermen are longlining in the Bahamas without obtaining a license.[146] Bahamian officials report that U.S. longliners and other fishermen are reportedly active in the northeastern Bahamas. There have not, however, been any longline seizures for some time. The longliners target tunas and swordfish. As U.S. waters are heavily fished, some U.S. fishermen are tempted to enter Bahamian waters and fish illegally. Bahamian officials also believe that sports fishermen or recreational fishermen often exceed bag limits.[147] Bahamian and United States enforcement officials cooperate on many issues. Many informal contacts occur and occasional formal consultations are held.[148] Bahamian authorities have authorized the U.S. Coast Guard (USCG) to conduct patrols in Bahamian waters. USCG under the authority of the Lacey Act will seize U.S. fishermen found to be violating Bahamian regulations. There is also USCG radar surveillance. The United States has a cooperative agreement with the Bahamas authorizing the United States to prosecute U.S. fishermen found to violate Bahamian regulations, a long-standing "Note of Support". NMFS Enforcement officials report a high degree of cooperation with Bahamian officials. Bahamian officials then participate in the legal proceedings, mostly civil cases, in U.S. courts and have made highly effective witnesses.[149]

XVIII. Future Trends

The Bahamas is one of the few countries in the wider Caribbean that has Government policies which discourage commercial longlining. The Bahamian fishing industry primarily targets spiny lobster. As a result of the Government's restrictive policy, there is no known pelagic longlining activity in the Bahamas, although swordfish and tunas could be taken in the western and northern Bahamas along the Gulf Stream by U.S. fishermen. U.S. longline fishermen are active in U.S. waters off Florida, but there is no Bahamian longline activity on the Bahamian side of the marine boundary. Swordfish and tunas, however, are present along both the eastern and western sides of the Gulf Stream. The resource is available, but the Bahamian fishermen are mostly focused on the lobster fishery. There have been some attempts to initiate a longline fishery. Because of the bycatch associated with the longlining, both artisanal and sport fishermen complained when longlining trials were conducted in the early 1990s. Tourism is the Bahamas' major industry and sport fishing and diving are important components of the tourist industry. Sport fishermen were very concerned about the possible impact of longlining on species taken by sports fishermen--especially billfish. Dive companies were concerned about sharks. The Government has not promoted the development of a longline fishery, and because of the complaints from both the artisanal and recreational fishermen, has adopted a policy discouraging Bahamians from initiating a commercial longline fishery. Thus Bahamian fishermen under the current regulatory regime will find it difficult to launch a pelagic longline fishery for swordfish, tunas, and related species. Bahamian officials stress that longlining has not been absolutely banned. Fishermen can submit applications. The Fishery Department, however, is likely to study any such applications very critically. There are currently no Bahamian commercial longline operations. And there is no indication that Bahamian officials plan to reconsider their restriction policy on longlining for the foreseeable future.

* * * *

Note: This chapter was designed and formatted by Vanessa Starks, a senior at Laurel High School in Laurel, Maryland. She has also prepared the computer graphics. Ms. Starks worked with the National Marine Fisheries Service as part of the Oak Ridge Institute for Science and Education. She hopes to pursue a career in either biology or medicine.

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Appendices

Series A: Biological Data
Series B: Catch
Series C: Bycatch
Series D: Sport Fishing
Series E: Trade
Series G: Foreign Catch Data
Series F: Enforcement

Appendix A1a.--United States. Monthly swordfish landings in the Bahamas, by month and size, 1988

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds						Number of Fish							
01-20	12	15	-	-	-	-	-	-	-	-	-	-	27
21-40	42	89	23	5	-	-	-	-	-	-	-	-	159
41-60	34	82	35	11	-	-	-	-	-	-	-	-	162
61-80	20	60	22	7	-	-	-	-	-	-	-	-	109
81-100	14	43	13	3	-	-	-	-	-	-	-	-	73
101-120	10	26	9	-	-	-	-	-	-	-	-	-	45
121-140	7	23	9	1	-	-	-	-	-	-	-	-	40
141-160	9	12	11	3	-	-	-	-	-	-	-	-	35
161-180	1	7	9	1	-	-	-	-	-	-	-	-	18
181-200	6	6	7	2	-	-	-	-	-	-	-	-	21
201-220	1	7	2	-	-	-	-	-	-	-	-	-	10
221-240	2	7	2	1	-	-	-	-	-	-	-	-	12
241-260	2	5	2	2	-	-	-	-	-	-	-	-	11
261-280	-	5	3	1	-	-	-	-	-	-	-	-	9
281-300	-	9	-	1	-	-	-	-	-	-	-	-	10
301-320	1	1	-	1	-	-	-	-	-	-	-	-	3
321-340	-	-	1	-	-	-	-	-	-	-	-	-	1
341-360	-	1	-	-	-	-	-	-	-	-	-	-	1
361-380	-	1	-	-	-	-	-	-	-	-	-	-	1
381-400	-	2	-	-	-	-	-	-	-	-	-	-	2
401-420	-	-	1	-	-	-	-	-	-	-	-	-	1
441-460	1	-	-	-	-	-	-	-	-	-	-	-	1
461-480	-	-	1	-	-	-	-	-	-	-	-	-	1
501-520	-	1	-	-	-	-	-	-	-	-	-	-	1
521-540	-	1	-	-	-	-	-	-	-	-	-	-	1
Total	162	403	150	39	-	-	-	-	-	-	-	-	745

Source: Southeast Fisheries Science Center.

Appendix A1b.--United States. Monthly swordfish landings in the Bahamas, by month and size, 1988

Weight	Month												Average/Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
						Pounds							
Mean size	76	89	101	107	-	-	-	-	-	-	-	-	90*
Total	12,457	36,202	15,288	4,200	-	-	-	-	-	-	-	-	68,147

* Average mean size
Source: Southeast Fisheries Science Center.

Appendix A2.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1985

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
21-40	-	-	-	-	8	-	-	-	-	-	-	-	8
41-60	-	-	-	-	24	-	-	-	-	-	-	-	24
61-80	-	-	-	-	20	-	-	-	-	-	-	-	20
81-100	-	-	-	-	24	-	-	-	-	-	-	-	24
101-120	-	-	-	-	6	-	-	-	-	-	-	-	6
121-140	-	-	-	-	8	-	-	-	-	-	-	-	8
141-160	-	-	-	-	6	-	-	-	-	-	-	-	6
161-180	-	-	-	-	4	-	-	-	-	-	-	-	4
181-200	-	-	-	-	2	-	-	-	-	-	-	-	2
201-220	-	-	-	-	2	-	-	-	-	-	-	-	2
221-240	-	-	-	-	3	-	-	-	-	-	-	-	3
241-260	-	-	-	-	3	-	-	-	-	-	-	-	3
261-280	-	-	-	-	2	-	-	-	-	-	-	-	2
281-300	-	-	-	-	2	-	-	-	-	-	-	-	2
Total	-	-	-	-	114	-	-	-	-	-	-	-	114

Source: Southeast Fisheries Science Center.

Appendix A3.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1986

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01- 20	-	-	-	2	-	18	-	-	-	-	-	-	20
21- 40	-	-	-	9	12	52	-	-	-	-	-	-	73
41- 60	-	-	-	15	9	24	-	-	-	-	-	-	48
61- 80	-	-	-	7	7	42	-	-	-	-	-	-	56
81-100	-	-	-	3	2	27	-	-	-	-	-	-	32
101-120	-	-	-	3	2	10	-	-	-	-	-	-	15
121-140	-	-	-	-	-	4	-	-	-	-	-	-	4
141-160	-	-	-	1	2	-	-	-	-	-	-	-	3
161-180	-	-	-	2	-	-	-	-	-	-	-	-	2
181-200	-	-	-	-	1	3	-	-	-	-	-	-	4
201-220	-	-	-	2	-	1	-	-	-	-	-	-	3
221-240	-	-	-	-	-	-	-	-	-	-	-	-	-
241-260	-	-	-	-	1	1	-	-	-	-	-	-	2
261-280	-	-	-	2	-	2	-	-	-	-	-	-	4
281-300	-	-	-	-	-	-	-	-	-	-	-	-	-
301-320	-	-	-	-	-	1	-	-	-	-	-	-	1
321-340	-	-	-	-	-	-	-	-	-	-	-	-	-
341-360	-	-	-	-	-	-	-	-	-	-	-	-	-
361-380	-	-	-	-	-	-	-	-	-	-	-	-	-
381-400	-	-	-	-	-	1	-	-	-	-	-	-	1
401-420	-	-	-	-	-	1	-	-	-	-	-	-	1
421-440	-	-	-	-	-	1	-	-	-	-	-	-	1
441-460	-	-	-	-	-	-	-	-	-	-	-	-	-
461-480	-	-	-	-	-	-	-	-	-	-	-	-	-
481-500	-	-	-	-	-	-	-	-	-	-	-	-	-
501-520	-	-	-	-	-	1	-	-	-	-	-	-	1
Total	-	-	-	46	36	189	-	-	-	-	-	-	271

Source: Southeast Fisheries Science Center.

Appendix A4.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1987

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	-	9	3	71	-	-	-	-	-	-	-	54	137
21-40	-	16	19	97	-	-	-	-	-	-	-	114	246
41-60	-	19	11	119	-	-	-	-	-	-	-	75	224
61-80	-	8	7	129	-	-	-	-	-	-	-	66	210
81-100	-	13	6	108	-	-	-	-	-	-	-	74	201
101-120	-	5	-	59	-	-	-	-	-	-	-	36	100
121-140	-	-	-	33	-	-	-	-	-	-	-	26	59
141-160	-	-	1	12	-	-	-	-	-	-	-	28	41
161-180	-	-	-	4	-	-	-	-	-	-	-	11	15
181-200	-	-	1	5	-	-	-	-	-	-	-	12	18
201-220	-	-	1	3	-	-	-	-	-	-	-	8	12
221-240	-	-	1	2	-	-	-	-	-	-	-	6	9
241-260	-	-	-	2	-	-	-	-	-	-	-	8	10
261-280	-	1	-	2	-	-	-	-	-	-	-	-	3
281-300	-	-	-	1	-	-	-	-	-	-	-	3	4
301-320	-	-	-	-	-	-	-	-	-	-	-	4	4
321-340	-	-	-	2	-	-	-	-	-	-	-	3	5
341-360	-	-	-	-	-	-	-	-	-	-	-	2	2
361-380	-	-	-	2	-	-	-	-	-	-	-	1	3
381-400	-	-	-	-	-	-	-	-	-	-	-	1	1
401-420	-	-	-	1	-	-	-	-	-	-	-	1	2
441-460	-	-	-	-	-	-	-	-	-	-	-	1	1
461-480	-	-	-	1	-	-	-	-	-	-	-	-	1
541-560	-	-	-	-	-	-	-	-	-	-	-	1	1
Total	-	71	50	653	-	-	-	-	-	-	-	535	1,309

Source: Southeast Fisheries Science Center.

Appendix A5.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1988

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	18	12	6	-	34	2	-	-	11	-	-	38	121
21-40	69	66	44	39	118	12	-	-	35	-	-	147	530
41-60	58	34	60	109	77	18	-	-	22	-	-	115	493
61-80	44	24	31	64	54	9	-	-	23	-	-	81	330
81-100	46	22	12	37	30	5	-	-	14	-	-	77	243
101-120	30	13	12	22	9	-	-	-	11	-	-	68	165
121-140	7	5	6	16	3	1	-	-	1	-	-	40	79
141-160	17	3	9	6	6	1	-	-	1	-	-	31	74
161-180	10	7	3	13	3	-	-	-	2	-	-	9	47
181-200	10	2	5	5	-	1	-	-	1	-	-	9	33
201-220	6	3	3	5	2	-	-	-	-	-	-	9	28
221-240	2	2	-	5	1	-	-	-	1	-	-	6	17
241-260	5	3	1	6	3	-	-	-	-	-	-	2	20
261-280	3	1	3	2	1	-	-	-	-	-	-	3	13
281-300	3	-	1	1	-	-	-	-	1	-	-	6	12
301-320	2	1	1	-	2	-	-	-	1	-	-	4	11
321-340	1	1	-	1	-	-	-	-	-	-	-	4	7
341-360	1	-	-	1	-	-	-	-	-	-	-	2	4
361-380	-	-	1	1	-	-	-	-	-	-	-	2	4
381-400	1	-	-	3	-	-	-	-	1	-	-	-	5
401-420	1	-	-	-	1	-	-	-	-	-	-	2	4
441-460	1	-	-	-	-	-	-	-	-	-	-	-	1
461-480	-	-	-	-	-	-	-	-	-	-	-	-	-
481-500	1	-	-	-	-	-	-	-	-	-	-	1	2
501-520	1	-	-	-	-	-	-	-	-	-	-	1	2
541-560	-	-	-	1	-	-	-	-	-	-	-	-	1
561-580	-	-	-	1	-	-	-	-	-	-	-	-	1
Total	337	192	198	338	344	49	-	-	125	-	-	657	2,247

Source: Southeast Fisheries Science Center.

Appendix A6.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1989

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds						Number of fish							
01-20	-	13	22	15	23	16	-	-	-	49	-	-	138
21-40	-	41	133	88	150	25	-	-	-	43	-	-	480
41-60	-	33	166	138	214	16	-	-	-	11	-	-	578
61-80	-	19	113	42	97	13	-	-	-	5	-	-	289
81-100	-	20	60	42	40	5	-	-	-	4	-	-	171
101-120	-	3	50	21	20	2	-	-	-	1	-	-	97
121-140	-	10	43	19	21	1	-	-	-	1	-	-	95
141-160	-	11	27	17	19	-	-	-	-	-	-	-	74
161-180	-	4	18	12	11	-	-	-	-	2	-	-	47
181-200	-	4	21	9	6	1	-	-	-	-	-	-	41
201-220	-	3	11	8	4	-	-	-	-	-	-	-	26
221-240	-	1	7	3	5	-	-	-	-	-	-	-	16
241-260	-	2	4	5	1	-	-	-	-	-	-	-	12
261-280	-	3	7	2	3	-	-	-	-	-	-	-	15
281-300	-	1	7	4	3	-	-	-	-	-	-	-	15
301-320	-	1	1	1	3	-	-	-	-	-	-	-	6
321-340	-	-	2	3	1	-	-	-	-	-	-	-	6
341-360	-	-	2	2	1	-	-	-	-	-	-	-	5
361-380	-	-	1	1	-	-	-	-	-	-	-	-	2
381-400	-	-	1	1	1	-	-	-	-	-	-	-	3
401-420	-	-	1	-	1	-	-	-	-	-	-	-	2
421-440	-	1	-	-	-	-	-	-	-	-	-	-	1
441-460	-	1	-	-	1	-	-	-	-	-	-	-	2
Total	-	171	697	433	625	79	-	-	-	116	-	-	2,121

Source: Southeast Fisheries Science Center.

Appendix A7.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1990

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds						Number of fish							
01-20	-	-	-	-	-	-	-	-	-	17	48	51	116
21-40	-	-	-	-	-	-	-	-	-	71	186	262	519
41-60	-	-	-	-	-	-	-	-	-	30	151	277	458
61-80	-	-	-	-	-	-	-	-	-	15	110	261	386
81-100	-	-	-	-	-	-	-	-	-	18	58	131	207
101-120	-	-	-	-	-	-	-	-	-	7	43	86	136
121-140	-	-	-	-	-	-	-	-	-	4	41	64	109
141-160	-	-	-	-	-	-	-	-	-	4	23	42	69
161-180	-	-	-	-	-	-	-	-	-	-	15	29	44
181-200	-	-	-	-	-	-	-	-	-	1	11	28	40
201-220	-	-	-	-	-	-	-	-	-	-	9	10	19
221-240	-	-	-	-	-	-	-	-	-	1	6	11	18
241-260	-	-	-	-	-	-	-	-	-	-	3	9	12
261-280	-	-	-	-	-	-	-	-	-	-	2	4	6
281-300	-	-	-	-	-	-	-	-	-	-	1	9	10
301-320	-	-	-	-	-	-	-	-	-	1	5	4	10
321-340	-	-	-	-	-	-	-	-	-	-	1	5	6
341-360	-	-	-	-	-	-	-	-	-	-	-	6	6
361-380	-	-	-	-	-	-	-	-	-	-	3	3	6
381-400	-	-	-	-	-	-	-	-	-	-	-	2	2
401-420	-	-	-	-	-	-	-	-	-	-	2	1	3
441-460	-	-	-	-	-	-	-	-	-	-	1	2	3
461-480	-	-	-	-	-	-	-	-	-	-	-	1	1
481-500	-	-	-	-	-	-	-	-	-	-	-	2	2
501-520	-	-	-	-	-	-	-	-	-	-	-	1	1
541-560	-	-	-	-	-	-	-	-	-	-	-	3	3
561-580	-	-	-	-	-	-	-	-	-	-	-	1	1
Total	-	-	-	-	-	-	-	-	-	169	719	1,305	2,193

Source: Southeast Fisheries Science Center.

Appendix A8.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1991

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	15	25	12	6	49	7	-	-	-	-	-	-	114
21-40	48	126	109	128	193	54	-	3	-	15	11	49	736
41-60	131	382	303	344	328	16	-	15	-	32	62	216	1,829
61-80	108	258	193	246	158	6	-	6	-	9	35	168	1,187
81-100	63	107	101	107	57	4	-	2	-	4	17	122	584
101-120	50	90	108	72	27	-	-	1	-	5	10	69	432
121-140	28	74	71	56	19	1	-	1	-	2	11	42	305
141-160	29	53	55	44	21	1	-	-	-	2	2	36	243
161-180	17	26	35	35	18	-	-	-	-	-	3	26	160
181-200	9	26	21	19	7	1	-	-	-	1	6	16	106
201-220	11	17	14	12	8	-	-	-	-	1	3	14	80
221-240	8	11	10	7	7	-	-	-	-	-	-	9	52
241-260	4	11	8	11	6	1	-	-	-	1	-	6	48
261-280	4	6	7	5	2	-	-	-	-	-	2	6	32
281-300	3	10	3	7	5	-	-	1	-	-	2	4	35
301-320	1	7	2	6	3	-	-	-	-	-	1	4	24
321-340	-	2	1	2	5	-	-	-	-	-	-	3	13
341-360	1	2	-	7	2	-	-	-	-	-	1	2	15
361-380	-	2	1	-	1	-	-	-	-	1	-	2	7
381-400	-	-	-	2	2	-	-	-	-	-	1	1	6
401-420	-	4	1	1	1	-	-	-	-	-	1	3	11
421-440	-	-	2	3	1	-	-	-	-	-	-	-	6
441-460	-	-	2	-	-	-	-	-	-	-	-	1	3
461-480	-	2	-	-	-	-	-	-	-	-	-	-	2
481-500	-	-	-	-	-	-	-	-	-	-	-	2	2
501-520	-	-	-	1	-	-	-	-	-	-	-	1	2
521-540	1	-	-	1	-	-	-	-	-	-	-	1	3
541-560	1	-	-	1	-	-	-	-	-	-	-	-	2
561-580	-	-	-	1	-	-	-	-	-	-	-	-	1
Total	532	1,241	1,059	1,124	920	91	-	29	-	73	168	803	6,040

Source: Southeast Fisheries Science Center.

Appendix A9.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1992

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	-	-	1	-	1	-	-	-	-	-	-	-	2
21-40	27	132	72	34	22	-	-	-	-	30	29	86	432
41-60	95	221	203	148	88	-	-	-	-	44	53	210	1,062
61-80	85	210	173	121	69	-	-	-	-	17	26	133	834
81-100	46	146	94	44	24	-	-	-	-	13	17	109	493
101-120	30	119	83	33	16	-	-	-	-	10	23	70	384
121-140	37	92	62	23	11	-	-	-	-	8	7	50	290
141-160	25	59	47	22	6	-	-	-	-	6	7	37	209
161-180	28	53	28	8	5	-	-	-	-	2	4	23	151
181-200	13	36	19	14	5	-	-	-	-	2	2	27	118
201-220	2	22	18	5	-	-	-	-	-	2	2	13	64
221-240	5	15	17	3	4	-	-	-	-	-	1	11	56
241-260	2	17	8	2	-	-	-	-	-	-	-	5	34
261-280	3	9	5	4	1	-	-	-	-	2	1	4	29
281-300	-	3	3	1	-	-	-	-	-	1	-	2	10
301-320	3	1	0	1	-	-	-	-	-	-	-	2	7
321-340	1	6	3	2	-	-	-	-	-	-	-	1	13
341-360	-	4	1	3	-	-	-	-	-	1	0	2	11
361-380	1	1	3	3	-	-	-	-	-	-	1	2	11
381-400	-	2	2	2	1	-	-	-	-	-	1	1	9
401-420	2	1	3	1	1	-	-	-	-	-	-	-	8
421-440	2	-	2	-	-	-	-	-	-	-	-	-	4
441-460	1	1	1	-	-	-	-	-	-	-	-	3	6
461-480	-	-	-	-	-	-	-	-	-	-	-	1	1
481-500	1	-	-	-	-	-	-	-	-	-	-	-	1
501-520	-	-	-	-	-	-	-	-	-	-	-	-	-
521-540	-	-	-	-	-	-	-	-	-	-	-	1	1
561-580	-	-	-	-	-	-	-	-	-	-	-	1	1
601-620	-	-	-	-	-	-	-	-	-	-	-	1	1
Total	409	1,150	848	474	254	-	-	-	-	138	174	795	4,242

Source: Southeast Fisheries Science Center.

Appendix A10.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1993

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	3	-	4	2	1	-	-	-	-	1	1	6	18
21-40	61	134	119	106	55	14	-	-	-	13	69	131	702
41-60	191	347	399	303	158	52	-	-	-	28	145	319	1,942
61-80	122	238	267	208	106	21	-	-	-	14	82	153	1,211
81-100	93	157	196	134	56	7	-	-	-	13	43	100	799
101-120	70	97	157	93	35	2	-	-	-	7	33	76	570
121-140	55	100	116	86	38	4	-	-	-	5	20	58	482
141-160	52	73	93	56	25	2	-	-	-	3	25	44	373
161-180	48	64	77	26	16	2	-	-	-	1	8	36	278
181-200	40	38	43	22	12	1	-	-	-	2	7	13	178
201-220	23	28	25	14	9	-	-	-	-	3	6	12	120
221-240	13	13	15	13	5	-	-	-	-	-	4	17	80
241-260	11	9	10	10	3	-	-	-	-	1	8	13	65
261-280	6	8	4	5	3	-	-	-	-	-	1	3	30
281-300	11	3	9	6	2	-	-	-	-	-	3	4	38
301-320	-	4	5	3	4	-	-	-	-	-	3	4	23
321-340	1	2	5	3	2	-	-	-	-	1	1	2	17
341-360	-	3	4	1	-	-	-	-	-	-	-	3	11
361-380	1	-	-	2	1	-	-	-	-	-	-	1	5
381-400	-	2	2	5	1	1	-	-	-	-	-	-	11
401-420	2	2	2	-	-	1	-	-	-	-	-	1	8
421-440	1	1	1	2	-	1	-	-	-	-	1	1	8
441-460	-	1	3	1	1	-	-	-	-	-	2	-	8
461-480	2	-	-	1	1	-	-	-	-	-	-	-	4
501-520	-	1	-	-	-	-	-	-	-	-	-	-	1
521-540	-	-	-	-	-	-	-	-	-	-	-	1	1
621-640	1	1	-	-	-	-	-	-	-	-	-	-	2
Total	807	1,326	1,556	1,102	534	108	-	-	-	92	462	998	6,985

Source: Southeast Fisheries Science Center.

Appendix A11.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1994

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	4	5	2	1	-	-	-	-	-	-	-	-	12
21-40	58	153	85	79	-	8	-	-	-	28	43	126	580
41-60	175	378	279	229	-	23	-	-	-	56	87	456	1,683
61-80	103	188	163	109	-	11	-	-	-	30	67	236	907
81-100	68	128	82	44	-	2	-	-	-	14	31	154	523
101-120	55	106	69	23	-	2	-	-	-	6	12	95	368
121-140	46	87	63	21	-	-	-	-	-	12	25	66	320
141-160	27	94	41	13	-	1	-	-	-	10	7	41	234
161-180	32	61	35	12	-	-	-	-	-	3	5	38	186
181-200	19	59	17	5	-	-	-	-	-	1	3	16	120
201-220	11	33	17	6	-	-	-	-	-	2	1	24	94
221-240	7	25	11	4	-	-	-	-	-	2	2	16	67
241-260	7	23	10	4	-	-	-	-	-	-	1	9	54
261-280	1	19	2	2	-	-	-	-	-	1	3	7	35
281-300	4	8	3	3	-	-	-	-	-	-	-	13	31
301-320	2	6	3	-	-	-	-	-	-	-	3	2	16
321-340	1	4	2	2	-	-	-	-	-	-	-	-	9
341-360	-	1	1	2	-	-	-	-	-	-	3	1	8
361-380	2	1	1	-	-	-	-	-	-	-	-	-	4
381-400	1	-	-	-	-	-	-	-	-	-	-	-	1
401-420	-	3	1	-	-	-	-	-	-	-	-	-	4
421-440	-	1	-	1	-	-	-	-	-	-	-	1	3
441-460	2	-	2	-	-	-	-	-	-	-	-	2	6
461-480	-	-	-	-	-	-	-	-	-	-	-	1	1
481-500	-	-	1	-	-	-	-	-	-	-	-	2	3
521-540	-	-	-	1	-	-	-	-	-	-	-	-	1
581-600	-	1	1	-	-	-	-	-	-	-	-	-	2
Total	625	1,384	891	561	-	47	-	-	-	165	293	1,306	5,272

Source: Southeast Fisheries Science Center.

Appendix A12.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1995

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	1	-	3	-	-	-	-	-	8	-	-	-	12
21-40	114	120	122	87	14	7	28	82	97	1	-	-	672
41-60	382	401	433	290	16	27	87	242	259	6	-	-	2,143
61-80	244	248	284	118	17	14	21	83	113	4	-	-	1,146
81-100	151	168	156	83	6	4	12	34	35	-	-	1	650
101-120	86	106	101	48	5	4	6	11	20	-	-	-	387
121-140	67	94	95	39	6	2	-	10	11	1	-	2	327
141-160	62	75	61	26	4	-	2	3	7	-	-	1	241
161-180	63	55	49	12	4	-	-	3	7	-	-	2	195
181-200	33	38	34	22	1	1	-	1	3	-	-	-	133
201-220	23	32	25	8	1	1	-	-	2	-	-	-	92
221-240	20	18	18	7	1	-	-	-	2	-	-	-	66
241-260	17	12	8	5	-	-	1	-	-	-	-	-	43
261-280	10	8	9	6	-	-	-	-	-	-	-	-	33
281-300	12	7	4	4	-	-	-	-	1	-	-	-	28
301-320	3	5	4	3	-	-	-	-	1	-	-	-	16
321-340	6	3	5	3	-	-	-	-	-	-	-	-	17
341-360	1	3	2	3	-	-	-	1	-	-	-	-	10
361-380	-	2	4	1	1	-	-	-	-	-	-	-	8
381-400	-	1	1	-	-	-	-	-	-	-	-	-	2
401-420	-	2	2	-	-	-	-	-	-	-	-	-	4
421-440	1	1	1	1	-	-	-	-	-	-	-	-	4
441-460	1	1	1	1	-	-	-	-	-	-	-	-	4
461-480	1	-	-	1	-	-	-	-	1	-	-	-	3
541-560	1	-	-	-	-	-	-	-	-	-	-	-	1
561-580	1	-	-	-	-	-	-	-	-	-	-	-	1
601-620	1	-	-	-	-	-	-	-	-	-	-	-	1
Total	1,301	1,400	1,422	768	76	60	157	470	567	12	-	6	6,239

Source: Southeast Fisheries Science Center.

Appendix A13.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1996

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	-	1	3	-	-	-	-	-	-	-	-	-	4
21-40	76	90	105	25	23	19	-	18	17	34	17	21	445
41-60	203	261	332	76	95	23	-	15	49	62	35	83	1,234
61-80	141	175	196	44	42	23	-	3	20	19	19	72	754
81-100	77	90	118	18	22	-	-	1	5	5	15	56	407
101-120	43	63	71	18	16	-	-	3	3	4	7	32	260
121-140	24	66	46	15	14	2	-	2	5	1	6	35	216
141-160	23	41	32	6	11	1	-	1	1	2	3	18	139
161-180	19	27	29	7	7	-	-	-	-	1	-	9	99
181-200	13	19	28	8	1	-	-	-	1	-	1	8	79
201-220	11	16	17	3	5	1	-	-	1	-	3	4	61
221-240	4	14	5	4	2	-	-	-	-	-	-	1	30
241-260	4	10	5	2	-	-	-	-	-	-	1	3	25
261-280	6	9	7	-	-	-	-	-	-	-	-	4	26
281-300	-	2	2	3	-	-	-	-	-	1	-	2	10
301-320	1	2	1	1	1	2	-	-	-	-	-	1	9
321-340	-	1	2	1	2	-	-	-	-	-	-	-	6
341-360	3	-	2	-	-	1	-	-	-	-	-	-	6
361-380	1	3	1	-	-	-	-	-	-	-	-	-	5
381-400	1	-	2	-	-	-	-	-	-	-	-	-	3
401-420	2	1	2	1	-	-	-	-	-	-	-	1	7
421-440	-	-	-	-	-	-	-	-	-	-	-	1	1
441-460	1	-	1	-	-	-	-	-	-	-	-	-	2
461-480	1	-	-	-	-	-	-	-	-	-	-	-	1
481-500	-	1	-	-	-	-	-	-	-	-	-	-	1
521-540	-	-	1	-	-	-	-	-	-	-	-	-	1
Total	654	892	1,008	232	241	72	-	43	102	129	107	351	3,831

Source: Southeast Fisheries Science Center.

Appendix A14.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1997

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
21-40	99	101	53	15	-	-	1	-	27	1	-	62	359
41-60	277	403	176	87	-	-	2	-	54	4	-	128	1,131
61-80	200	262	98	50	-	-	-	-	14	-	-	79	703
81-100	105	140	38	21	-	-	1	-	5	2	-	78	390
101-120	67	84	33	17	-	-	-	-	4	-	-	43	248
121-140	49	76	31	10	-	-	-	-	1	1	-	29	197
141-160	41	49	19	14	-	-	-	-	1	-	-	23	147
161-180	31	49	12	5	-	-	-	-	4	-	-	17	118
181-200	22	26	6	3	-	-	-	-	1	-	-	12	70
201-220	14	22	8	2	-	-	-	-	-	-	-	14	60
221-240	8	16	5	3	-	-	-	-	1	-	-	6	39
241-260	2	9	2	2	-	-	-	-	-	-	-	4	19
261-280	5	7	1	1	-	-	-	-	-	-	-	5	19
281-300	6	8	2	-	-	-	-	-	-	-	-	1	17
301-320	2	5	-	-	-	-	-	-	-	-	-	4	11
321-340	2	1	-	-	-	-	-	-	-	-	-	1	4
341-360	2	3	-	-	-	-	-	-	-	-	-	-	5
361-380	1	2	-	-	-	-	-	-	1	-	-	-	4
381-400	-	-	-	1	-	-	-	-	-	-	-	1	2
401-420	-	-	-	-	-	-	-	-	-	-	-	1	1
441-460	-	-	-	-	-	-	-	-	-	-	-	1	1
501-520	-	-	-	-	-	-	-	-	-	-	-	1	1
Total	933	1,263	484	231	-	-	4	-	113	8	-	510	3,546

Source: Southeast Fisheries Science Center.

Appendix A15.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1998

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
01-20	-	-	1	-	-	-	-	-	-	-	-	-	1
21-40	64	73	131	1	-	-	-	-	-	-	26	60	355
41-60	142	218	369	9	-	-	-	-	-	-	19	158	915
61-80	107	168	245	3	-	-	-	-	-	-	14	112	649
81-100	63	89	147	-	-	-	-	-	-	-	9	84	392
101-120	60	63	89	-	-	-	-	-	-	-	9	61	282
121-140	37	41	72	1	-	-	-	-	-	-	7	50	208
141-160	27	37	58	-	-	-	-	-	-	-	5	31	158
161-180	24	27	34	-	-	-	-	-	-	-	3	20	108
181-200	13	28	26	-	-	-	-	-	-	-	2	14	83
201-220	14	16	22	-	-	-	-	-	-	-	1	13	66
221-240	11	6	14	-	-	-	-	-	-	-	1	11	43
241-260	6	5	8	1	-	-	-	-	-	-	1	3	24
261-280	5	4	4	-	-	-	-	-	-	-	1	4	18
281-300	1	1	6	-	-	-	-	-	-	-	-	5	13
301-320	3	1	1	-	-	-	-	-	-	-	-	3	8
321-340	2	1	-	-	-	-	-	-	-	-	-	1	4
341-360	2	4	1	-	-	-	-	-	-	-	-	3	10
361-380	-	-	3	-	-	-	-	-	-	-	-	-	3
381-400	-	-	2	-	-	-	-	-	-	-	-	1	3
401-420	-	1	-	-	-	-	-	-	-	-	-	1	2
421-440	-	1	-	-	-	-	-	-	-	-	-	1	2
441-460	-	-	-	-	-	-	-	-	-	-	-	1	1
461-480	2	-	-	-	-	-	-	-	-	-	-	-	2
481-500	-	1	-	-	-	-	-	-	-	-	-	-	1
Total	583	785	1,233	15	-	-	-	-	-	-	98	637	3,351

Source: Southeast Fisheries Science Center.

Appendix A16.--United States. Monthly swordfish landings data in Florida (east coast), by size, 1999

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
21-30	-	-	1	-	3	-	-	-	-	-	-	-	4
31-40	26	33	56	59	41	-	-	-	-	-	2	-	217
41-50	41	51	115	80	50	-	-	-	-	-	4	-	341
51-60	35	36	74	60	25	-	-	-	-	-	7	-	237
61-70	23	24	66	43	22	-	-	-	-	-	6	-	184
71-80	24	22	34	16	11	-	-	-	-	-	1	-	108
81-90	18	19	23	23	4	-	-	-	-	-	1	-	88
*91-100	12	17	31	14	8	-	-	-	-	-	0	0	82
101-110	14	12	20	11	5	-	-	-	-	-	1	-	63
111-120	9	12	14	16	8	-	-	-	-	-	1	-	60
121-130	7	5	22	13	5	-	-	-	-	-	1	-	53
131-140	11	10	13	12	6	-	-	-	-	-	3	-	55
141-150	10	8	20	12	7	-	-	-	-	-	3	-	60
151-160	5	6	17	12	3	-	-	-	-	-	-	-	43
161-170	5	8	19	4	2	-	-	-	-	-	-	-	38
171-180	5	4	16	12	2	-	-	-	-	-	1	-	40
181-190	5	8	6	1	2	-	-	-	-	-	1	0	23
191-200	6	1	15	3	2	-	-	-	-	-	-	-	27
201-210	3	5	8	2	-	-	-	-	-	-	-	-	18
211-220	-	1	3	7	2	-	-	-	-	-	-	-	13
221-230	2	2	5	1	1	-	-	-	-	-	-	-	11
231-240	6	1	2	3	1	-	-	-	-	-	1		14
241-250	1	3	5	1	1	-	-	-	-	-	-	-	11
251-260	1	2	1	2	1	-	-	-	-	-	-	-	7
261-270	-	1	1	1	1	-	-	-	-	-	-	-	4
271-280	-	-	-	2	-	-	-	-	-	-	-	-	2
281-290	-	-	-	-	1	-	-	-	-	-	-	-	1
*291-300	1	-	-	1	-	-	-	-	-	-	-	-	2
301-310	-	3	-	-	-	-	-	-	-	-	-	-	3
311-320	-	-	-	1	-	-	-	-	-	-	-	-	1
321-330	-	-	-	2	-	-	-	-	-	-	-	-	2
331-340	1	1	-	2	-	-	-	-	-	-	-	-	4
351-360	-	-	-	1	-	-	-	-	-	-	-	-	1
381-390	1	1	-	-	-	-	-	-	-	-	-	-	2
401-410	-	-	1	-	-	-	-	-	-	-	-	-	1
421-430	-	-	1	-	-	-	-	-	-	-	-	-	1
Total	272	296	589	417	214	-	-	-	-	-	33	-	1,821

* These fish were identified as 91-110 and 291-310 respectively. For statistical convenience, the authors have included them with the 91-100 and 291-300 categories.
Source: Southeast Fisheries Science Center.

Appendix B1.--Bahamas. Fisheries catch, 1980-96

Year	Catch
	Metric tons
1980	5,026
1981	4,372
1982	4,868
1983	5,211
1984	5,341
1985	7,629
1986	5,893
1987	7,069
1988	7,062
1989	8,082
1990	7,498
1991	9,199
1992	9,846
1993	10,073
1994	9,703
1995	9,557
1996	9,776
1997	10,439

Source: FAO, *Yearbook of Fishery Statistics*, (FAO: Rome, various years).

Appendix B2a.--Bahamas. Swordfish catch, 1990-98

Year	Catch		U.S.	
	FAO	ICCAT	Landings	Imports**
		Metric tons		
1987	-	NA	-	-
1988	-	NA	44.1	-
1989	-	NA	2.6	-
1990	-	NA	-	-
1991	-	NA	-	1.1
1992	-	NA	-	-
1993	-	NA	-	0.4
1994	-	NA	-	-
1995	-	NA	-	-
1996	-	NA	-	-
1997			-	-
1998			-	-

* Live-weight equivalents of U.S. landings in the Bahamas.
** Based on U.S. import trends. This is a minimum estimate as there were also probably some domestic consumption.
Note: U.S. imports (appendix ?) and landings (appendix ?) were converted to live weight based on a conversion factor of 1.4.
NA - Not available
Source: FAO, *Yearbook of Fishery Statistics*, various years; ICCAT, *Statistical Yearbook*, various years; NMFS Southeast Fisheries Science Center; and U.S. Bureau of the Census, unpublished data.

Appendix B2b.--United States. Swordfish landings in the Bahamas, 1984-98

Year	Landings
	Metric tons*
1984	-
1985	-
1986	-
1987	-
1988	30.9
1989	1.8
1990	-
1991	-
1992	-
1993	-
1994	-
1995	-
1996	-
1997	-
1998	-

* Product, primarily trunk weight
Source: Southeast Fisheries Science Center, National Marine Fisheries Service.

Appendix C1.--Bahamas. Shark catch, 1990-97

Year	Catch
	Metric tons
1990	-
1991	-
1992	-
1993	37
1994	Negl
1995	Negl
1996	5
1997	3

Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix C2a.--Bahamas. Turtle harvest, 1986-88

Species	Quantity			Value		
	1986	1987	1988	1986	1987	1988
	Metric tons			US$1,000		
Greens	10.9	5.2	4.0	38.8	14.5	14.1
Hawksbills	4.8	-	-	17.1	-	-
Leatherbacks	-	-	-	-	-	-
Loggerheads	5.7	9.4	9.9	16.0	36.2	42.0
Total*	21.4	14.6	13.9	72.0	50.3**	56.0

* Totals may not agree due to rounding.
** As reported in source.
Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix C2b.--Bahamas. Turtle harvest, 1990-97

Year	Harvest
	Metric tons
1990	12
1991	8
1992	6
1993	4
1994	2
1995	2
1996	3
1997	3

Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix C3a1.--United States. Estimated fish catch in longline fishing effort, southeastern area, 1993

Species		Individuals*	Kept	Discarded		Catch
Common Name	Scientific Name			Dead	Alive	share
		Number		Percent		
Swordfish	Xiphias gladius	29,794	0.45	0.44	0.11	41.72
Dorado	Coryphaenidae	10,674	0.98	0.01	0.01	14.95
Yellowfin tuna	Thunnus albacares	5,316	0.76	0.16	0.08	7.44
Silky shark	Carcharhinus falciformis	4,994	0.33	0.42	0.26	6.99
Atlantic sailfish	Istophorus platypterus	2,401	0.00	0.54	0.46	3.36
Bigeye tuna	Thunnus obesus	1,822	0.76	0.04	0.20	2.55
Dusky shark	Carcharhinus obscurus	1,522	0.09	0.47	0.44	2.13
White marlin	Tetrapturus albidus	1,372	0.00	0.54	0.46	1.92
Albacore tuna	Thunnus alalunga	1,222	0.98	0.00	0.02	1.71
Shark	Carcharinidea	1,157	0.00	0.30	0.70	1.62
Blue marlin	Makaira nigercans	1,136	0.00	0.21	0.79	1.59
Escolar	Lepidocybium flavobrunneum	1,072	0.35	0.32	0.33	1.50
Scallop hammerhead	Sphyrna lewini	986	0.07	0.43	0.50	1.38
Blue shark	Prionace glauca	900	0.00	0.07	0.93	1.26
Tiger shark	Galeocerdo cuvieri	664	0.00	0.06	0.94	0.93
Sandbar shark	Carcharhinus milberti	664	0.26	0.27	0.47	0.90
Lancetfish	Alephisauridae	643	0.00	0.57	0.43	0.90
Oil fish	Ruvetus pretiosus	600	0.11	0.39	0.50	0.84
Wahoo	Acanthocybium solandri	514	0.92	0.04	0.04	0.72
Oceanic whitetip shark	Carcharhinus longlimanus	429	0.10	0.15	0.75	0.66
Hammarhead	Sphyrna sp.	386	0.00	0.55	0.45	0.54
Barracuda	Sphyraenidae	364	0.00	0.18	0.82	0.51
Blacktip shark	Carcharhinus limbatus	300	0.00	0.93	0.07	0.42
Blackfin tuna	Thunnus atlanticus	257	0.58	0.25	0.17	0.36
Shortfin mako	Isurus oxyrinchus	257	0.75	0.00	0.25	0.36
Bigeye thresher shark	Alopias superciliosus	236	0.00	0.55	0.45	0.33
Other fish		214	0.10	0.30	0.70	0.30
Great hammarhead	Sphyrna mokarran	171	0.00	0.25	0.75	0.24
Bonito	Sarda sarda	171	0.00	1.00	0.00	0.24
Skates/rayes	Chondrichthyes	150	0.00	0.00	1.00	0.21
Puffer	Tetraodontidea	129	0.33	0.17	0.50	0.18
Common thresher	Alopias vulpinus	86	0.00	0.50	0.50	0.12
Longnose spearfish	Tetrapterus pfluergri	64	0.00	0.33	0.67	0.09
Longfin mako shark	Isurus paucus	64	0.00	0.33	0.67	0.09
Bluefin tuna	Thunnus thynnus	64	0.33	0.67	0.00	0.09
Tuna		64	0.00	0.67	0.33	0.09
Bigeye cigarfish	Cupiceps spp	43	1.00	0.00	1.00	0.06
Snake mackerel	Trichiuridae	43	0.00	1.00	0.00	0.06
Pomphret	Bramidae	43	0.00	0.00	1.00	0.06
Sunfish	Mola	43	0.00	0.00	1.00	0.06
Bull shark	Carcharhinus leucas	43	0.00	0.50	0.50	0.06
Night shark	C. signatuds	43	0.00	0.50	0.50	0.06
Spearfish	Tetrapterus spp	21	0.00	0.00	1.00	0.03
Mako shark	Isurus sp.	21	0.00	0.00	1.00	0.03
Spinner shark	Carcharhinus brevipinna	21	1.00	0.00	0.00	0.03
Skipjack tuna	Katsuwonus pelamis	21	0.00	1.00	0.00	0.03
Little tuna	Euthynnus alletteratus	21	0.00	0.00	1.00	0.03

* 1993 catch estimated from observer catch rates and reported effort
Source: Jean Cramer, "Large pelagic logbook newsletter - 1994," *NOAA Technical Memorandum*, NMFS-SEFSC-378 (NMFS, Southeast Fisheries Science Center: Miami, November, 1995), pp. 31-32.

Appendix C3a2.--United States. Estimated fish catch in longline fishing effort, southeastern area, 1993

Species	Individuals*	Kept	Discarded		Catch share
			Dead	Alive	
	Number		Percent		
Swordfish	29,794	0.45	0.44	0.11	41.72
Dorado	10,674	0.98	0.01	0.01	14.95
Tunas					
Yellowfin tuna	5,316	0.76	0.16	0.08	7.44
Bigeye tuna	1,822	0.76	0.04	0.20	2.55
Albacore tuna	1,222	0.98	0.00	0.02	1.71
Blackfin tuna	257	0.58	0.25	0.17	0.36
Bluefin tuna	64	0.33	0.67	0.00	0.09
Tuna	64	0.00	0.67	0.33	0.09
Skipjack tuna	21	0.00	1.00	0.00	0.03
Little tuna	21	0.00	0.00	1.00	0.03
Subtotal	8,766				12.30
Billfish					
Atlantic sailfish	2,401	0.00	0.54	0.46	3.36
White marlin	1,372	0.00	0.54	0.46	1.92
Blue marlin	1,136	0.00	0.21	0.79	1.59
Longnose spearfish	64	0.00	0.33	0.67	0.09
Spearfish	21	0.00	0.00	1.00	0.03
Subtotal	4,994				6.99
Sharks					
Silky shark	4,994	0.33	0.42	0.26	6.99
Dusky shark	1,522	0.09	0.47	0.44	2.13
Shark	1,157	0.00	0.30	0.70	1.62
Scallop hammerhead	986	0.07	0.43	0.50	1.38
Blue shark	900	0.00	0.07	0.93	1.26
Tiger shark	664	0.00	0.06	0.94	0.93
Sandbar shark	664	0.26	0.27	0.47	0.90
Oceanic whitetip shark	429	0.10	0.15	0.75	0.66
Hammarhead	386	0.00	0.55	0.45	0.54
Blacktip shark	300	0.00	0.93	0.07	0.42
Shortfin mako	257	0.75	0.00	0.25	0.36
Bigeye thresher shark	236	0.00	0.55	0.45	0.33
Great hammarhead	171	0.00	0.25	0.75	0.24
Common thresher shark	86	0.00	0.50	0.50	0.12
Longfin mako shark	64	0.00	0.33	0.67	0.09
Bull shark	43	0.00	0.50	0.50	0.06
Night shark	43	0.00	0.50	0.50	0.06
Mako shark	21	0.00	0.00	1.00	0.03
Spinner shark	21	1.00	0.00	0.00	0.03
Subtotal	12,944				18.15
Other					
Snake mackerels					
Escolar	1,072	0.35	0.32	0.33	1.50
Oil fish	600	0.11	0.39	0.50	0.84
Lancetfish	643	0.00	0.57	0.43	0.90
Wahoo	514	0.92	0.04	0.04	0.72
Barracuda	364	0.00	0.18	0.82	0.51
Bonito	171	0.00	1.00	0.00	0.24
Skates/rayes	150	0.00	0.00	1.00	0.21
Puffer	129	0.33	0.17	0.50	0.18
Bigeye cigarfish	43	1.00	0.00	1.00	0.06
Snake mackerel	43	0.00	1.00	0.00	0.06
Pomphret	43	0.00	0.00	1.00	0.06
Sunfish	43	0.00	0.00	1.00	0.06
Other	214	0.10	0.30	0.70	0.30

* 1993 catch estimated from observer catch rates and reported effort
Source: Jean Cramer, "Large pelagic logbook newsletter - 1994," *NOAA Technical Memorandum*, NMFS-SEFSC-378 (NMFS, Southeast Fisheries Science Center: Miami, November, 1995), pp. 31-32.

Appendix C4.--Bahamas. Seabird nesting, 1984

Area	Information	Species*	Known** threats	Importance***
Bahamas	Poor	3, 6, 7, 8?, 10-14, 16, 17?, 18-20, 22	Ex, Ha, Pr?	Important
Turks and Caicos	Reasonable	3, 6, 7, 10-12, 13?, 14?, 16?, 17?, 18-20, 22	Ex?	Important

* Species: 3 - Puffinus l. lherminieri; 5 - Phaethon aethereus; 6 - P. lepturus; 7 - Fregata magnificens; 8 - Sula dactylatra; 10 - Sula leucogaster; 11 - Pelecanus occidentalis; 12 - Larus atricilla; 13 - Sterna maxima, 14 - S. sandvicensis acuflavida; 15 - S. (s.) eurygnatha; 16 - S. dougallii; 17 - S. hiundo; 18 -S. anaethetus; 19 - S. fuscata; 20 - S. (albifrons) antillarum; 22 - A. stolidus
** Threats: Ex - exploitation of eggs, young or adults; Pr - predators, generally introduced mammals; Ha - habitat destruction or disturbances; Po - pollution; Fi - fisheries
*** A rough subjective rating of relative importance of area for breeding seabirds.
Source: Ruud van Halewyn and Robert L. Norton, "The status and conservation of seabirds in the Caribbean," in J.P. Croxall, P.G.H. Evans, and R.W. Schreiber (eds.), "Status and conservation of the world's seabirds," *ICBP Technical Publication*, No. 2 (ICBP: Cambridge, 1984), pp. 175-176.

Appendix D.--Bahamas. Sport fishing tournaments, 1999

Date*	Species	Name	Location
January 7-10	Wahoo	Bahamas Wahoo Championship (3rd Leg)	Abaco Beach Resort Abacos
January 21-24	Wahoo	Bahamas Wahoo Championship (4th Leg)	Valentines Yacht Club Harbour Island
February 4-8	Wahoo	Bahamas Wahoo Championship (5th Leg)	Bimini Big Game Club Bimini
March 15-20	Billfish	19th Annual Bacardi Rum Billfish Tournament	Bimini Big Game Club Bimini
April 13-18	Billfish	Bahamas Billfish Championship (1st Leg)	Chub Cay Club Berry Islands
April 26-May 1	Billfish	Bahamas Billfish Championship (2nd Leg)	Treasure Cay Resort & Marina Abacos
May 17-22	Billfish	Bahamas Billfish Championship (3rd Leg)	Walkers Cay Resort & Marina Abacos
May 31-June 5	Billfish	Bahamas Billfish Championship (4th Leg)	Boat Harbour Great Abaco Beach Resort Abacos
June 14-19	Billfish	Bahamas Billfish Championship	Harbour Island Valentines Yacht Club North Eleuthra
September	Billfish	Small boat tournament	Bimini Big Game Fishing Club Bimini

* These dates will change from year to year, but are usually held at about the same time each year.
Source: Various recreational fishing sources.

Appendix E1.--Bahamas. Swordfish exports by destination, 1991-98

Destination	Year									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Metric tons									
United States	-	1	-	Negl	-	-	-	-	-	-
Japan**	-	-	-	-	-	-	-	-	-	-*
European Union	NA	-	-	-	-	-	-	-	-	-P
Others**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	NA	1	-	Negl	-	-	-	-	-	-

* Through November
** Swordfish shipments to other countries are believed to be non-existent or negligible
NA - Not available
P Preliminary
Source: Various

Appendix E2a1.--United States. Swordfish imports from Bahamas, 1975-2000

Year	Commodity		Total*
	Fresh	Frozen	
	Metric tons		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985	-	-	-
1986	-	1.0	1.0
1987	-	-	-
1988	-	-	-
1989	-	-	-
1990	-	-	-
1991	0.8	-	0.8
1992	-	-	-
1993	0.3	-	0.3
1994	-	-	-
1995	-	-	-
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999	-	-	-
2000	-**	-**	-**

* Totals may not agree due to rounding.
** Through April
Source: U.S. Bureau of the Census

Appendix E2a2.--United States. Swordfish imports from Bahamas, 1975-2000

Year	Commodity		Total*
	Fresh	Frozen	
	US$1,000		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985	-	-	-
1986	-	8	8
1987	-	-	-
1988	-	-	-
1989	-	-	-
1990	-	-	-
1991	7	-	7
1992	-	-	-
1993	2	-	2
1994	-	-	-
1995	-	-	-
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999	-	-	-
2000	-	-	-
2001	-**	-**	-**

* Totals may not agree due to rounding
** Through April
Source: U.S. Bureau of the Census

Appendix E2b.--United States. Tuna imports from the Bahamas, 1990-2000

Year	Quantity	Value
	Metric tons	US$1,000
1990	-	-
1991	0.5	3.1
1992	-	-
1993	3.9	19.0
1994	-	-
1995	-	-
1996	-	-
1997	-	-
1998	-	-
1999	-	-
2000	-	-
2001	-*	-*

* Through April
Source: U.S. Bureau of the Census.

Appendix F1.--Foreign fishermen. Swordfish catch reported in ICCAT statistical area 2570*

Country	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
		Metric tons				
Cuba	No fishing					
Japan	1963		0.2	5.3	0.1	5.7
	1964		0.6	0.1		0.7
	1965		1.5			1.5
	1966		0.6			0.6
	1967		1.2	0.2		1.4
	1968	0.1	0.3			0.4
	1969			0.1		0.1
	1970	0.1	1.0	0.3		1.4
	1971		0.1			0.1
	1974	1.0				1.0
	1984			0.1		0.1
	1987		0.1			0.1
	1996	3.5				3.5
Korea	1977	2.1	1.1			3.2
	1979		1.7			1.7
	1982			0.4		0.4
Spain	No fishing					
Taiwan	1970		0.2			0.2
	1971	0.9				0.9
	1973	5.3				5.3
	1974		1.2			1.2
	1978		0.5			0.5
	1986	0.8	0.1			0.9
	1987	0.7				0.7
United States	Data not available**					

* ICCAT square are 5° degree squares of latitude and longitude. The first two numbers are the latitude and the second two numbers are the longitude. This represents the southeastern corner of the 5° square for catches in quadrant 4, northwest Atlantic.
** The authors encountered apparent statistical problems with the U.S. data on the ICCAT web site beginning in 1987. Apparently ICCAT is in the process of recalculating the 1° square data by 5° squares.
Source: ICCAT: http://www.iccat.es/Stats.html, retrieved August 1, 2000

Appendix F2.--Foreign fishermen. Swordfish catch reported in ICCAT statistical area 2575*

Country	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
		Metric tons				
Cuba	No fishing					
Japan	1964		0.6	0.6		1.2
	1965	0.2	2.9			3.1
	1966		7.0			7.0
	1967		0.7			0.7
	1968		0.3			0.3
	1969		0.2	0.1		0.3
	1970				0.2	0.2
	1971		2.2		0.1	2.3
	1972			0.5		0.5
	1975	7.4				7.4
	1976	4.7				4.7
	1977	0.2				0.2
	1978	0.4				0.4
	1979	0.4				0.4
Korea	No fishing					
Spain	No fishing					
Taiwan	1970		0.2			0.2
	1974	0.7	2.7			3.4
	1976		4.1			4.1
United States	Data not available**					

* ICCAT square are 5° degree squares of latitude and longitude. The first two numbers are the latitude and the second two numbers are the longitude. This represents the southeastern corner of the 5° square for catches in quadrant 4, northwest Atlantic.

** The authors encountered apparent statistical problems with the U.S. data on the ICCAT web site beginning in 1987. Apparently ICCAT is in the process of recalculating the 1° square data by 5° squares.

Source: ICCAT: http://www.iccat.es/Stats.html, retrieved August 1, 2000

Appendix G1.--Bahamas. Prosecutions of U.S. swordfish fishermen violating U.S swordfish regulations in Bahamian waters, 1985-96

Year	Violation		Cases
	Regulation	Description	
	USC*		Number
1985	630.7(a)(1)	Landing swordfish without permit	2
1986	630.7(a)(1)	Landing swordfish without permit	1
	630.7(a)(3)	Failure to report required information	1
1987	630.7(a)(1)	Landing swordfish without permit	2
	630.7(a)(3)	Failure to report required information	272
1988	630.7(a)(1)	Landing swordfish without permit	17
	630.7(a)(3)	Failure to report required information	1
	630.7(c)	Failure to report required information	234
	630.7(d)	Failure to maintain vessel markings	1
1989	630.7(a)	Landing swordfish without permit	31
	630.7(c)	Failure to report required information	1
	630.7(d)	Failure to maintain vessel markings	2
	630.7(g)	Failure to report required information	1
1990	630.7(a)	Landing swordfish without permit	12
	630.7(f)	Failure to display permit	2
1991	630.7(a)	Landing swordfish without permit	7
	630.7(d)	Failure to maintain vessel markings	4
	630.7(f)	Failure to display permit	4
	630.7(j)	Possessing undersized swordfish	2
1992	630.7(a)	Landing swordfish without permit	6
	630.7(d)	Failure to maintain vessel markings	1
	630.7(h)	Failure to maintain vessel markings	1
	630.7(q)	Possessing undersized swordfish	3
1993	630.7(a)	Landing swordfish without permit	6
	630.7(b)	Taking and selling swordfish**	1
	630.7(c)	Selling swordfish to unpermitted dealer	2
	630.7(d)	Failure to maintain vessel markings	4
	630.7(f)	Failure to display permit	1
	630.7(h)	Failure to maintain vessel markings	1
	630.7(q)	Possessing undersized swordfish	3
1994	630.7(a)	Landing swordfish without permit	1
	630.7(d)	Purchasing swordfish without dealers permit	1
	630.7(f)	Failure to display permit	1
	630.7(h)	Failure to maintain vessel markings	1
	630.7(q)	Possessing undersized swordfish	6
	630.7(r)	Possessing swordfish not in whole condition	2
1995	630.7(a)	Landing swordfish without permit	5
	630.7(c)	Selling swordfish to unpermitted dealer	1
	630.7(d)	Purchasing swordfish without dealers permit	2
	630.7(q)	Possessing undersized swordfish	4
	630.7(s)	Possession of swordfish during a closure	1
1996***	630.7(q)	Procession of undersized swordfish	1

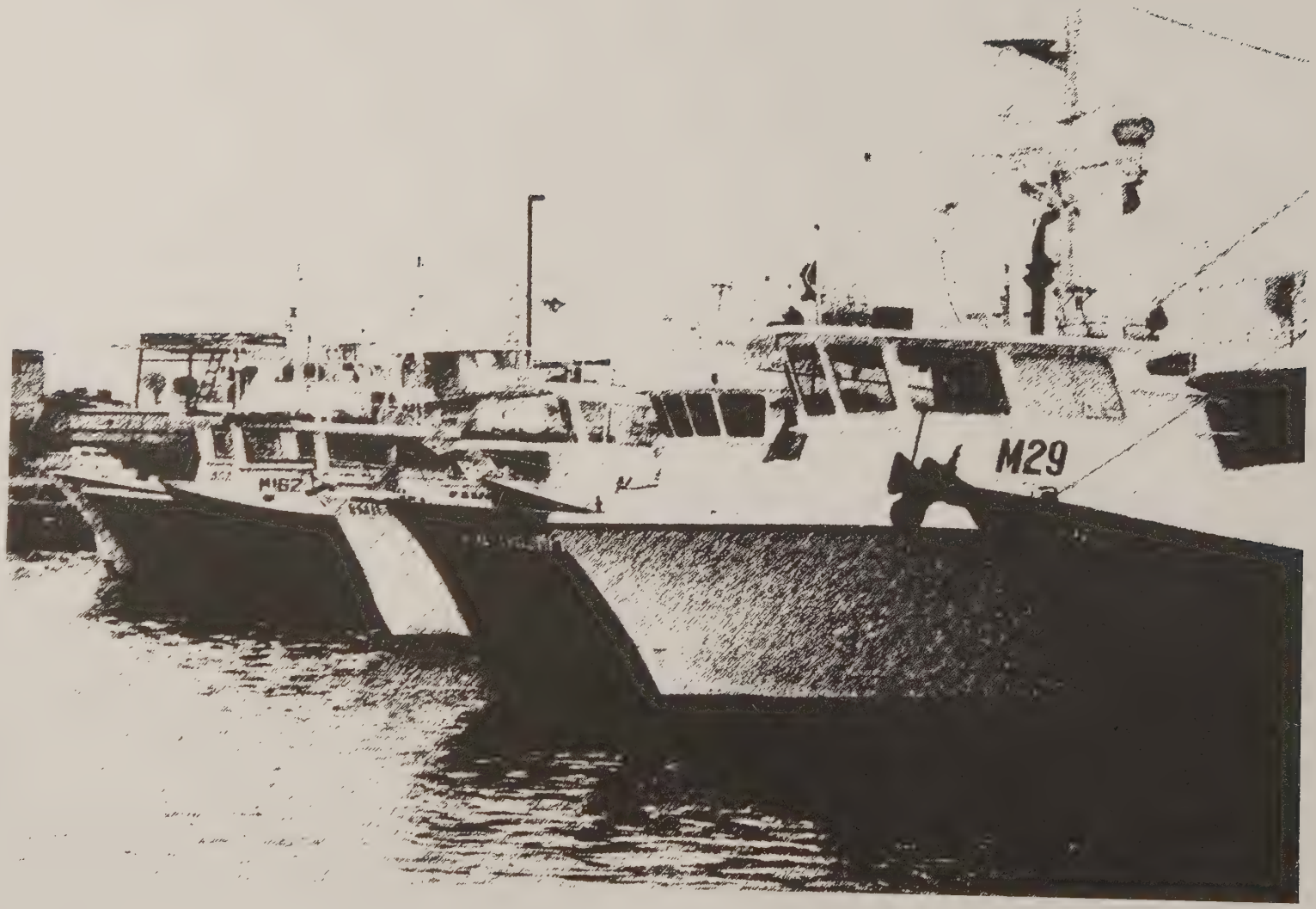
* U.S. Magunson Fisheries Conservation and Management Act
** To an unpermitted dealer
*** Through February 13
Source: National Marine Fisheries Service, F/SER

Appendix G2. Bahamas. Cooperative enforcement actions with the United States

CCN	DATE	LOCATION	VIOLATION
SE900173A	18-APR-1990	BAHAMIAN WATERS	LA/BAH
SE900173B	18-APR-1990	BAHAMIAN WATERS	LA/BAH
SE900195A	30-APR-1990	BAHAMIAN WATERS	LA/BAH
SE900195A	30-APR-1990	BAHAMIAN WATERS	LA/BAH
SE910053A	09-FEB-1991	CAY SAL BANK, BAHAMAS	LA/BAH
SE910053A	09-FEB-1991	CAY SAL BANK, BAHAMAS	LA/BAH
SE910197A	06-MAY-1991	NASSAU SOUND, BAHAMAS	TEDS/ATL-MOD
SE910197B	06-MAY-1991	NASSAU SOUND, BAHAMAS	TEDS/ATL-MOD
SE910535A	22-AUG-1991	BAHAMIAN WATERS	LA/BAH
SE910602A	18-SEP-1991	MATINILLA SHOAL, BAHAMAS	LA/BAH
SE920012A	27-JAN-1992	BAHAMIAN EEZ	LA/BAH
SE920030A	04-FEB-1992	BAHAMIAN EEZ	LA/BAH
SE920030B	04-FEB-1992	BAHAMIAN EEZ	LA/BAH
SE920036A	09-FEB-1992	BAHAMIAN WATERS	LA/BAH
SE920046A	14-FEB-1992	BAHAMIAN EEZ	LA/BAH
SE920175A	20-MAY-1992	BAHAMAS	LA/BAH
SE920177A	17-MAY-1992	BAHAMAS	LA/BAH-WAIVER
SE920178A	17-MAY-1992	BAHAMAS	LA/BAH-WAIVER
SE920357A	14-APR-1992	BAHAMAS	LA/BAH
SE920443A	02-NOV-1992	N/A	LONGLINING IN BAHAMIAN EEZ
SE930148A	16-MAY-1993	MIAMI, FL	IMPORTING FROM BAHAMAS OVERLIMIT YELLOWTAIL SNAPPERS
SE930189A	05-JUL-1993	BAHAMIAN WATERS	POSSESSION OF 40 LBS FILLET - NO BAHAMIAN FISHING LICENSE
SE930192A	13-JUN-1993	BAHAMIAN WATERS	LA/STATE-OTHER
SE930292A	07-AUG-1993	ORMOND BCH, FL -CORAL TAKEN IN BAHAMIAN WATER	LA/BAH
SE940133A	10-APR-1994	BAHAMAS/US EEZ OFF JUPITER	LA/BAH
SE940133A	10-APR-1994	BAHAMAS/US EEZ OFF JUPITER, FL	POSSESSION OF GROUPER WITHOUT HEAD AND FINS INTACT
SE940196A	16-MAY-1994	N/A	COMMERCIAL FISHING IN BAHAMAS WITHOUT PERMIT
SE960165A	25-JUN-1996	N/A	EXCEED BAHAMIAN BAG LIMIT FOR RECREATIONAL FISH
SE960197A	21-JUL-1996	MIAMI OUTBOARD CLUB	IMPORT OVER BAHAMIAN BAG LIMIT
SE960225A	19-AUG-1996	RETURNING FROM BAHAMAS	POSSESS 5 GROUPER WITHOUT HEAD AND FINS INTACT
SE960311A	05-DEC-1996	BAHAMIAN EEZ	LA/BAH

SE980172A	09-JUN-1998	BAHAMAS	UNLAWFUL IMPORTATION MUTTON SNAPPER
SE980172A	09-JUN-1998	BAHAMAS	POSSESS MUTTON SNAPPER WITHOUT PERMIT
SE990383A	21-SEP-1999	BAHAMAS/FLORIDA	IMPORTATION OF FISH TRAPPED IN BAHAMIAN WATERS
SE990465A	01-OCT-1999	INDIAN RIVER, FL	ILLEGAL IMPORTATION OF BAHAMIAN SEA PRODUCTS
SE990576A	02-NOV-1999	FORT LAUDERDALE EXEC AIRPORT	POSSESS 54 LBS. SPINY LOBSTER OVER BAHAMIAN EXPORT LIMIT
SE990667A	09-DEC-1999	MIAMI/BAHAMAS	IMPORT FISH FROM BAHAMANIAN WATERS
SE000252A	03-MAR-2000		LACEY ACT/BAHAMIAN
SE000620A	15-JUN-2000	BAHAMAS	SETTING PELAGIC LONGLINE GEAR IN THE BAHAMAS

Source: NMFS Southeast Fisheries Conference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4

BARBADOS

Barbados fishermen deploy one of the larger commercial pelagic longline fleets of all the Caribbean island countries--with the exception of Cuba which does not extensively operate its longliners in the Caribbean. The Barbados fleet is also one of the few Caribbean fleets which take swordfish. The Barbados fishery in the 1980s was mostly conducted by day-boats and ice-boats targeting surface species. Fishing was highly seasonal and based to a great extent on one species--flyingfish. Foreign fishermen have been active around Barbados, especially the Asian longline countries, Japan, Korea, and Taiwan. Only Taiwan continues active of the Asian countries, but Cuba has operated around Bermuda and U.S. fishermen tranship small quantities of swordfish and tuna through Bridgetown. The introduction of longliners in the late 1980s significantly expanded the local fishing industry and the variety of species it was able to supply the local market. The Fisheries Division considers the pelagic longline fleet to be one of the most promising sectors of the Barbados fishing industry, but believes that the significant expansion of the fleet for the time being appears to have ended. The country's longline fishery grew out of experimental fishing by ice boat fishermen who began experimenting with small longlines. The Government sponsored test fishing to help assess the potential and locate prospective fishing grounds. The Barbadian fleet operates fairly close to the island, usually within the country's 200-mile EEZ. Small swordfish catches have been reported, but the fleet currently focuses on surface tunas like yellowfin as well as billfish which is an important fishery commodity on the island. The fleet has mostly developed locally. A few U.S. captains have been contracted, but operations have primarily been conducted by Barbadian captains. The fishermen generally deploy relatively short lines and few of the vessels have echo sounders. None of the vessels use satellite imagery to help locate the most productive fishing grounds. Yields tend to be relatively low. The current operations do not appear to be returning high profits, although some of the fishermen do better than those focusing on more costal resources. Other fishermen report operations that loose money. Some have ceased operations. Investors who often are not the vessel captains face some constraints in introducing new technology needed to make their vessels more efficient. Based on the profitability achieved to date, any major expansion of the Barbados longline fishery at this time appears unlikely. The Barbados Cabinet in 2000 approved the decision to join the International Commission for the Conservation of Atlantic Tunas (ICCAT). Barbados hopes to obtain what they consider to be a more appropriate catch allocation for Barbados by participating in the Commission. Barbados is not a member of the Organization of Eastern Caribbean States (OECS), but is active in regional fishery activities such as cooperation on management and enforcement issues.

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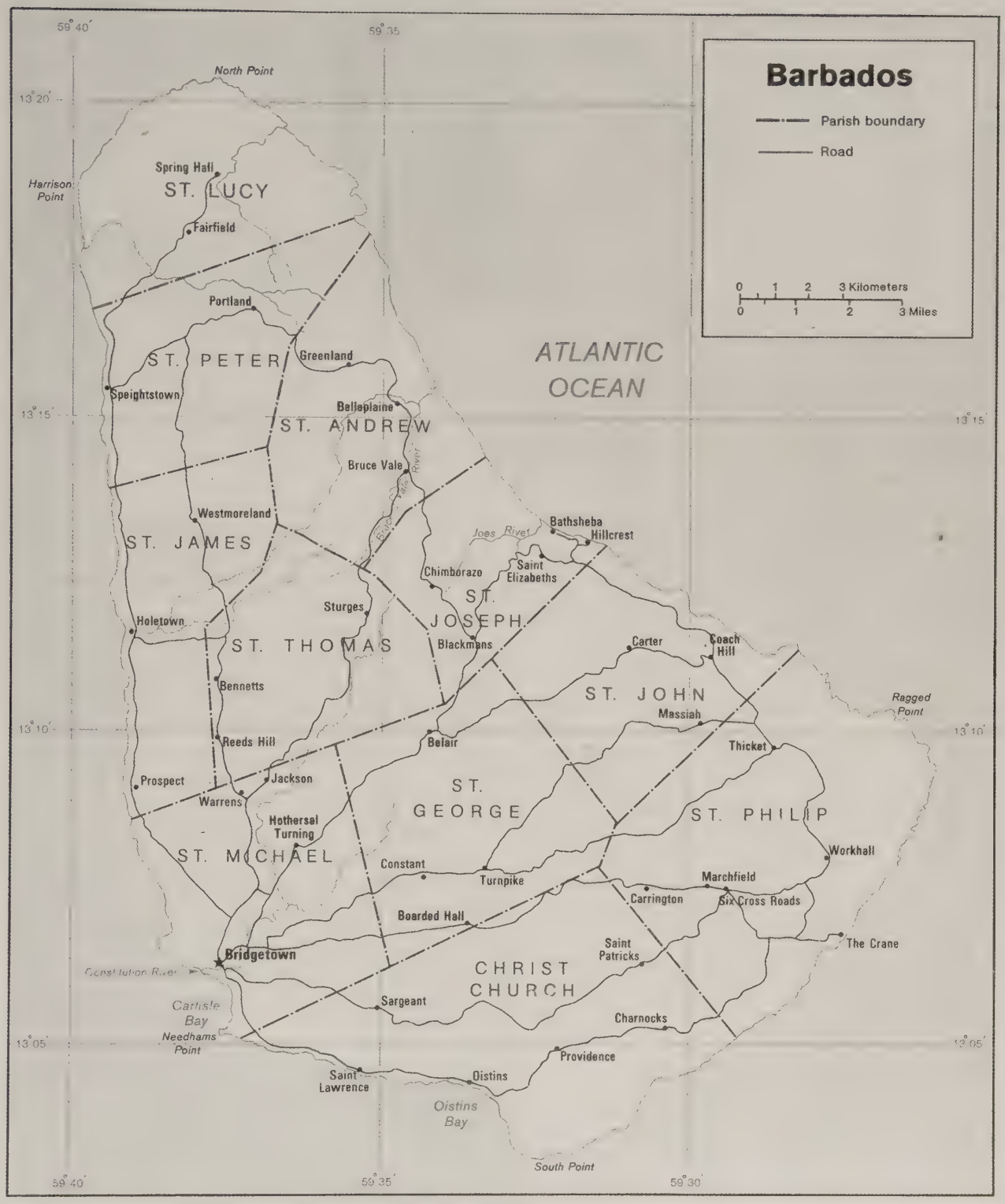

Figure 1--Map of Barbados.

I. Background

A. General

Barbados is a former British colony with a somewhat different colonial history than many of the other Caribbean islands. Barbados through its entire history has only been governed by only one colonial power--Britain. In contrast to most of the other Caribbean islands, the British colonial planters actually settled on the island after the Spanish had the indigenous population driven off or shipped to as slaves to Hispaniola. The colonialists, but not the Africans brought to the island to work as slaves on sugar cane plantations, have thus enjoyed the right of local representative government almost from the beginning of the colony in the early 17th century. The Barbados House of Assembly, in continuous session since 1639, is the third oldest legislative body in the Western Hemisphere, preceded only by Bermuda and the Virginia House of Burgesses.

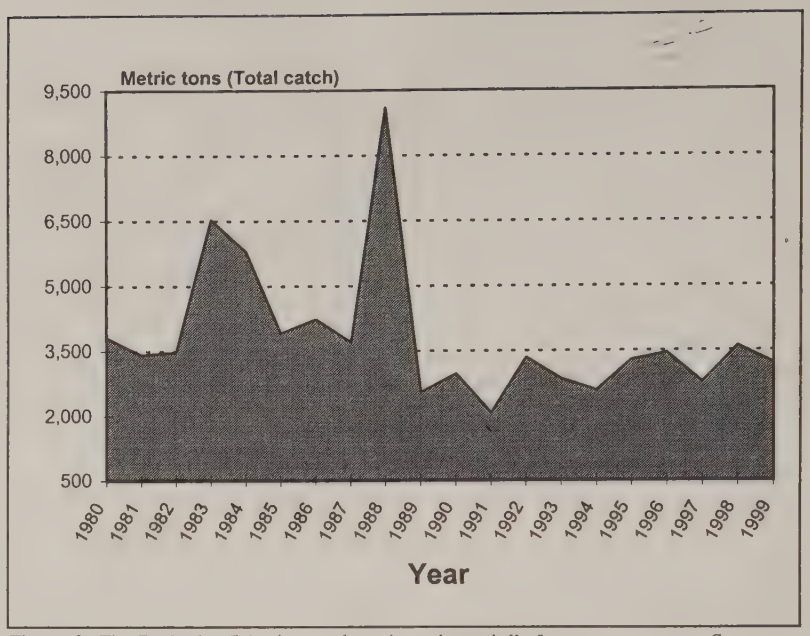

Figure 2--The Barbados fisheries catch varies substantially from year to year. Some very substantial catches were reported in the 1980s.

Barbados participated in the short lived West Indies Federation (1958-62). When the Federation terminated, Barbados reverted to the status of a self-governing colony until achieving independence within the Commonwealth in 1966. The government is a Westminster-style parliamentary system. The British monarch is the head of state and is represented on the island by the Governor General.

Barbados is somewhat isolated from the rest of the Lesser Antilles. It is actually not located within the Caribbean Basin. It is the most easterly of the Caribbean island states and is situated well out into the Atlantic. It is about 400 kilometers (km) northeast of Trinidad and eastern Venezuela and 150 km directly east of St. Vincent in the Windward islands.

B. Fishing industry

The Barbados fishing industry is a small part of the country's economy. Fisheries accounts, as is the case on many Caribbean islands, for only about 1 percent of the national income.[1] The industry plays an important role, however, in supplying domestically produced high protein food, creating jobs in outlying areas, and providing an attraction for the important tourist industry. The industry provides employment for about 2,200 fishermen, over 80 percent full-time. The percentage of full-time fishermen is larger than on most Caribbean islands. Sport fishing is a popular activity and the Fisheries Division (FD) of the Ministry of Agriculture and Rural Development points out that "... the fishing industry is part of the island experience that visitors seek and is hence an asset to tourism."[2]

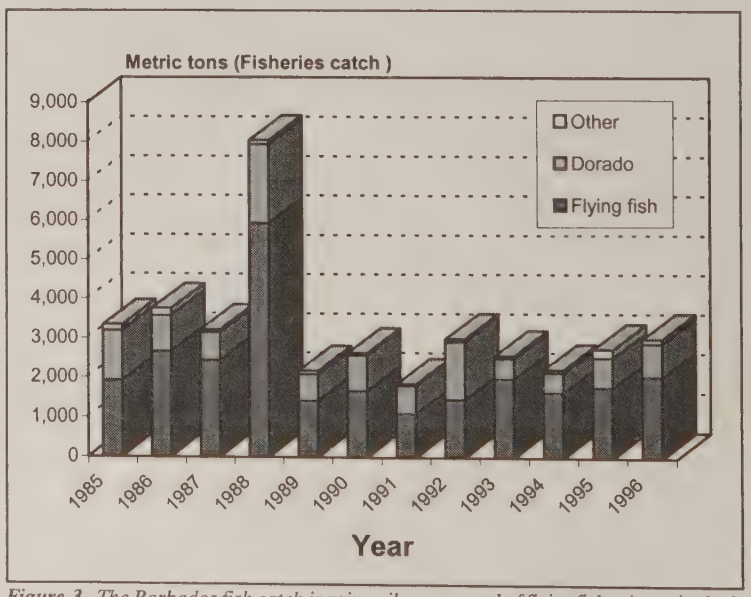

Figure 3--The Barbados fish catch is primarily composed of flyingfish. A particularly large catch was reported in 1988.

The Barbados fishing industry is a largely artisanal activity, focusing on a variety of species with various gear. Many of the inshore resources are heavily fished as demonstrated by declines in the overall fisheries catch during recent years (appendix C1a). Some potential, however, does exist for expansion in specific fisheries.

Flyingfish: The Barbados fishery focuses primarily on one species--flyingfish. Few countries have fishing industries as devoted to one species as is the case on Barbados. Flyingfish can account for more than half the Barbadian catch.[3] The fishermen, using both dayboats and iceboats, employ gillnets, handlines, and dipnets in coastal and oceanic fisheries.[4] The resource status is unknown, but the FD believes that there is some evidence that the potential exists for "cautious expansion".[5]

Reeffish: Both shallow-shelf species (such as parrotfish and surgeonfish) and deep-slope species (snappers and groupers) are harvested using traps, set nets, spear guns, and handlines. These fisheries are pursued on coastal coral reefs, banks, and on the shelf slope. Many inshore areas are heavily fished, but preliminary studies suggest there is some potential for expanding effort in deeper waters on the shelf slope.

Coastal pelagics: Species such as herrings, jacks, and small tunas are taken by handline, troll lines, cast nets, and seine nets in coastal fisheries. No data is available on the resource status.

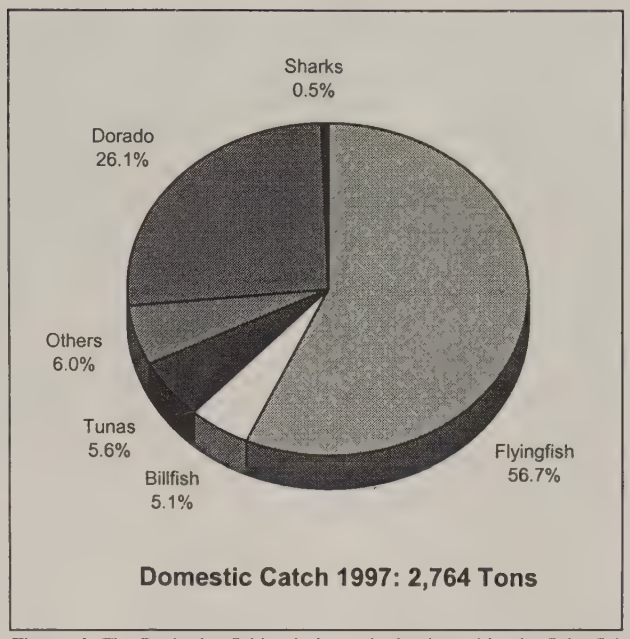

Figure 4--The Barbados fishing industry is dominated by the flyingfish fishery, although the actual proportion varies from year to year.

Photo 1.--A small typical Barbados artisanal boat returning to port after a fishing trip. Dennis Weidner

Large pelagics: Dorado (dolphins), tunas, kingfish, swordfish, and shark are taken by handline, troll lines, and longline in oceanic fisheries by a small but growing Barbadian fleet. While a small part of the country's overall fishing industry, the fishery for these species can be highly lucrative for skilled fishermen.[6] The extent of the dorado resource is unknown. The International Commission for the Conservation of Atlantic Tunas (ICCAT) assessments suggest that stocks of several important highly migratory species are fully utilized or over-exploited in their overall north Atlantic range. Many of the species involved, like swordfish, are managed by ICCAT which assigns country catch limits to members based on historical catches and other factors (appendix H3b). The small Barbados catch is a negligible part of the overall north atlantic catch.

Other: A variety of other smaller fisheries for sea urchins, lobsters, and other species are also pursued.[7]

The Barbados fishing fleet is largely artisanal and has been expanding in recent years. About 85 percent of the fleet is composed of small, traditional dayboats or moses. Fishermen deployed about 500 boats. The Fisheries Division reported a fleet of about 700 boats in 1993.[8] The fleet by 1995 had further expanded to 760 moses, launches or dayboats, iceboats, and, for the first time--longliners.[9] The nature of the artisanal fishery has shifted in recent years from mostly small day boats to larger ice boats which may spend 4-10

Photo 2.--Barbadian fisherman deploying a gillnet for flying fish. Martyn Melhuish

days on the fishing grounds. The growing importance of longliners has added further diversity to the country's fishing fleet and resulting catch.

The Barbados fishing catch has fluctuated substantially in recent years. The country's catch has ranged in recent years from a high of 9,100 (1988) to a low of only 2,100 t (1991) (appendix C1a). Such large fluctuations are not unusual in a fishery dependent primarily on one pelagic species. Short lived pelagic species are noted for such large annual fluctuations. These large fluctuations are due primarily due to natural fluctuations in the highly variable fishery for flyingfish. In the 1990s there has been no substantial increase in the fisheries catch despite the increases in the number of fishing vessels. Catches in the 1990s have ranged between 3,400 t (1996) and 2,100 t (1991). The 1997 catch totaled nearly 2,800 t, substantially less than the level being reported in the early 1980s. The catch is not very diverse. Flyingfish can be 50-60 percent of the catch and dorado can be 20-30 percent. The overall Barbados fishery is thus normally determined by results in these two fisheries.

The Barbados fishery, especially the pelagic fishery which accounts for the bulk of the catch, is highly seasonal. This seasonality has had a significant impact on the structure of the Barbados fishing industry and fishing and marketing patterns.[10] There are periods where there is very little fish in the local market. Work for the eastern Caribbean as a whole shows a similar pattern of peak catches from December to June.[11]

The great bulk of the Barbados catch is taken within the islands 200-mile Exclusive Economic Zone (EEZ). Only limited operations extend beyond Barbadian waters to grounds off Trinidad-Tobago and other Caribbean islands. Barbadian fishermen have been most active off nearby Tobago where flyingfish can be caught. The Government negotiated a bilateral access agreement with Trinidad in 1990, but it lasted

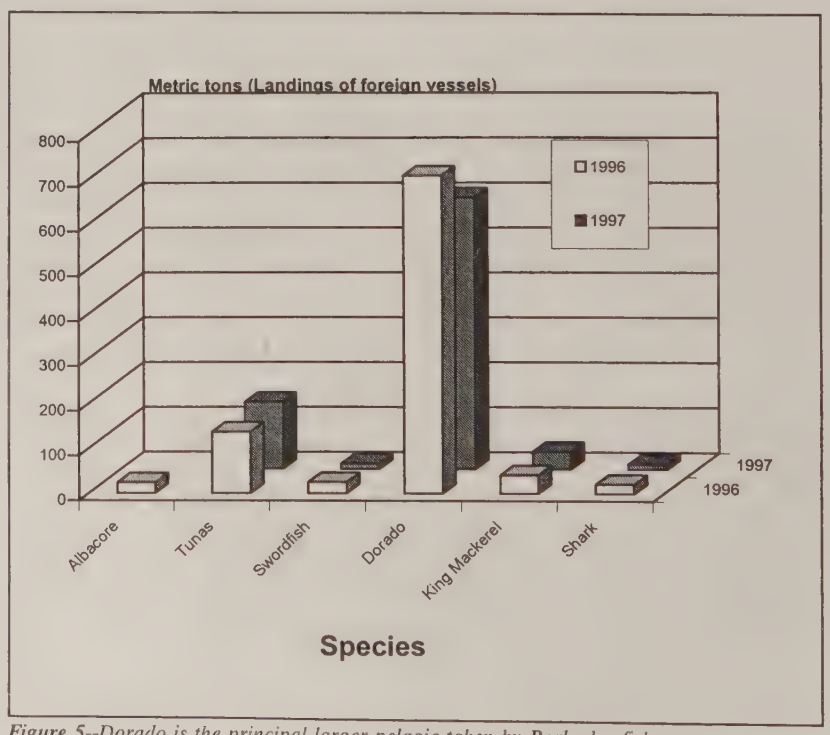

Figure 5--Dorado is the principal larger pelagic taken by Barbados fishermen.

only 1 year and was not renewed. Commercial fishing operations are limited. Shrimp trawlers were deployed off Brazil and the Guianas during the 1960s and 1970s, but this fishery was closed when the coastal countries denied access to the Barbadian fishermen. A Barbados company also deployed two large longliners off Brazil in the 1990s, but this operation also ultimately proved unsuccessful.

The commercial fishery is currently conducted by about 100 iceboats and 30 small longliners. Most of the longliners were acquired gradually throughout the 1990s (appendix A2b). The longliners target tuna and billfish, but take a range of different species including swordfish as well. The swordfish catch, however, appears to be limited. Some U.S. longliners operating in the Atlantic and Caribbean have landed small quantities of swordfish at Bridgetown for transhipment to U.S. markets (appendices C3c1 and C3f).

Photo 3.--This artisanal boat at the Bridgetown port is docking so that the crew can land the catch. Dennis Weidner

Seafood is popular in Barbados and an important part of the local diet. Income levels are high on Barbados in comparison to many other Caribbean islands and their is a strong domestic market for seafood. The domestic fishermen do not catch enough fish to fully meet domestic demand. At times the locally fishing markets are almost devoid of product--especially during the offseason as both major species, particularly flyingfish, are highly seasonal. The important tourist industry, in particular, creates the demand for a wide variety of high-value species. The declining catch and growing population have exacerbated the supply deficit in recent years. The fact that domestic fishermen land primarily two species, flyingfish and dorado, severely restricts the variety of species commonly available in local markets. The development of the longline fishery in the 1990s has helped to increase the variety of species landed and available to local consumers and tourists. Even so, Barbados still has to import 6,000-9,000 t of seafood annually (Caribbean Overview, appendix F1a). These imports include a substantial quantity of billfish, primarily supplied by Taiwan fishermen landing their catch at Port of Spain, Trinidad.[12]

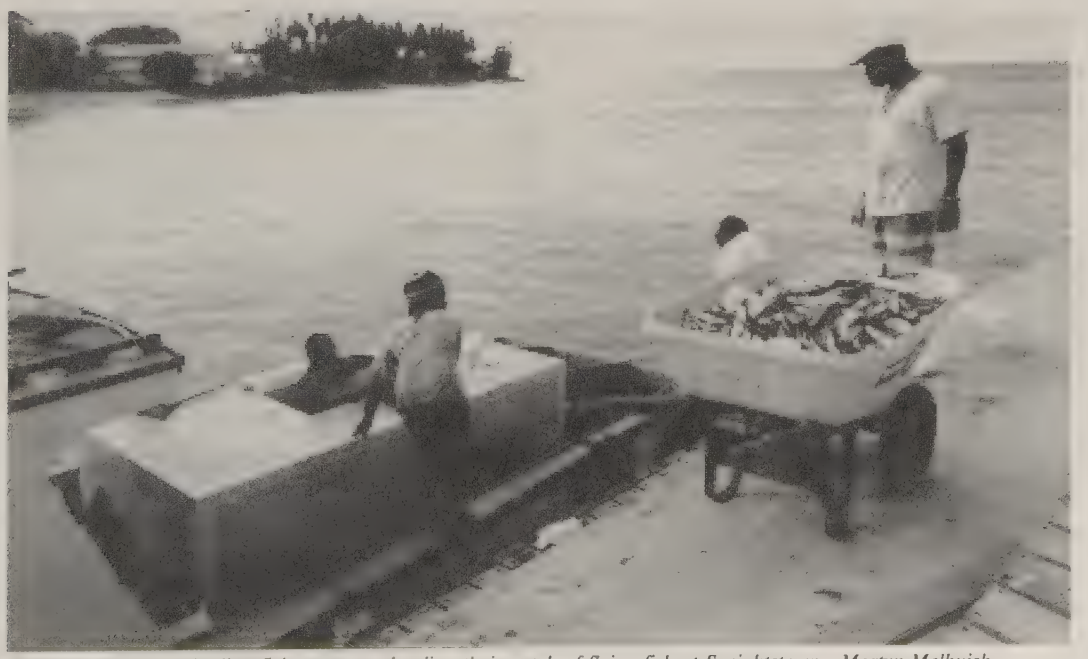
Photo 4.--These Barbadian fishermen are landing their catch of flying fish at Speightstown. Martyn Melhuish

II. Species

The authors know of no studies describing swordfish stocks and behavior off Barbados. Researchers at the Bellairs Research Institute (BRI), however, have published some work on billfish and smaller pelagics like flyingfish, wahoo, and dorado, but there has been no work on swordfish.

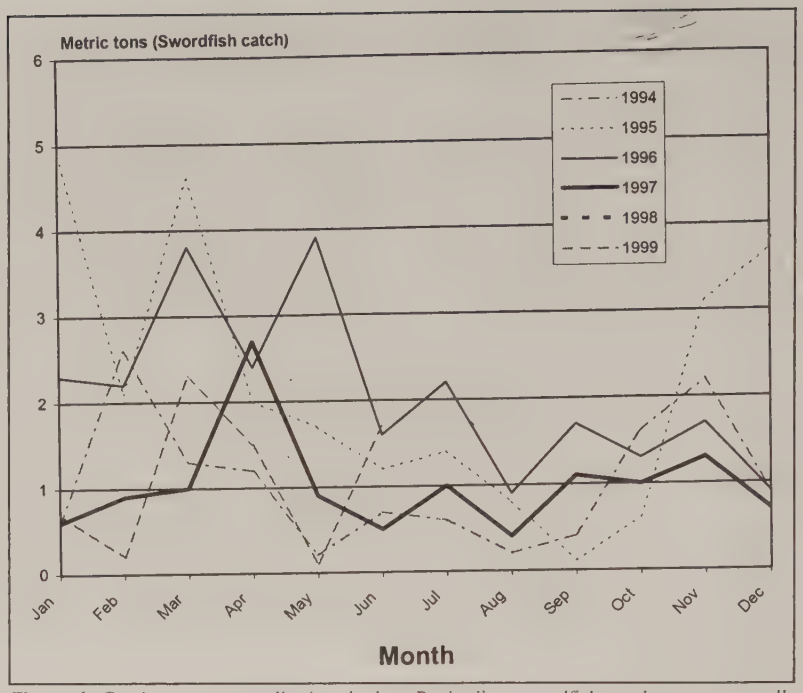

Figure 6--Catches vary annually, but the best Barbadian swordfish catches are generally reported at the beginning of the year.

A. Spawning

The spawning grounds for swordfish is primarily deduced by the location and abundance of larvae. Swordfish larvae appear most prevalent in the western Caribbean. Studies have found, however, that swordfish larvae are present in both the eastern and western Caribbean. Small swordfish larvae are not very abundant in the eastern Caribbean. Larger larvae ($\geq$10 mm) are most common from December to May. Larvae have been found around Barbados as well as to the south and west.[13] Another study reported that larvae were more common in the northern Antilles and the southern part of the Sargasso Sea.[14] A more recent study which surveyed available data reported larger larvae around Barbados, but less commonly than to the north around Puerto Rico and the northeastern Caribbean (Venezuela, figure 10). That same study discussed the possibility that the Gulf Stream may be transporting larvae north along the U.S. coast.[15] Current transport may also be moving larvae spawned in the Atlantic off South America to Barbados and onto the Caribbean. This could be a mixing mechanism for the theorized south and north Atlantic stocks.

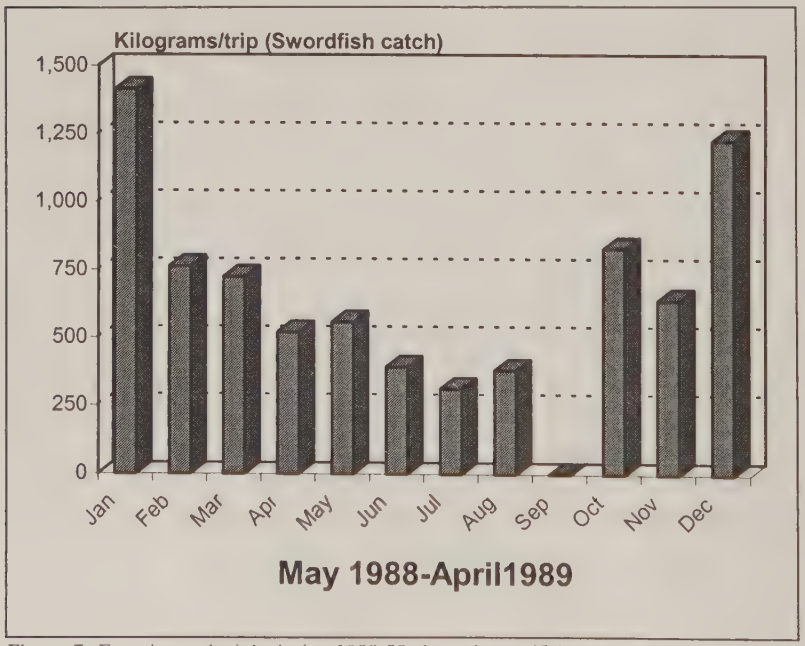

Figure 7--Experimental trials during 1988-89 showed swordfish catch yields of over 1,400 kg per trip.

B. Seasonality

The main pelagic fishing season in Barbados generally peaks during April and May. The low point of the year is usually August and September. Billfish catches are more varied with two or three peaks seasonally, often with the highest landings in November and December. The varied catch patterns may reflect the fact that billfish is not a principal target species and only an incidental catch. Observers speculate that these catch rates may be affected by the seasonal movement of the fish, migrating from the temperate waters along the U.S. coast during the cooler winter months.[16] Smaller peaks in March and April during the main pelagic season suggest a return migration to the north during the summer. There may also be individuals who remain year round in the Caribbean, perhaps

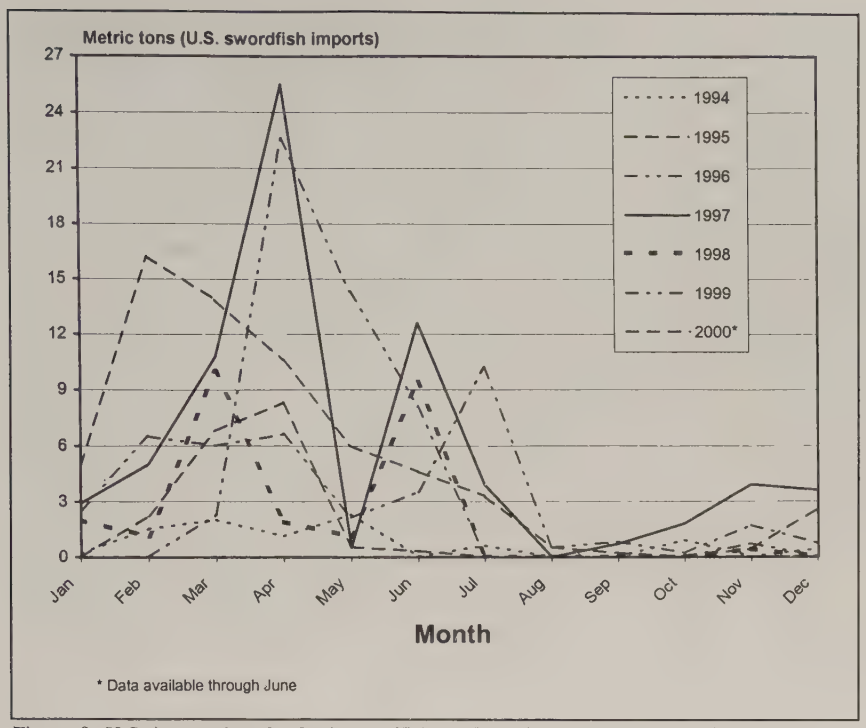

Figure 8--U.S. import data for fresh swordfish confirms the seasonal nature of the fishery.

moving locally and affecting the seasonal abundance on each island. Other possible factors could be involved such as local environmental variability. Freshwater outflow from the Orionoco River during the Venezuelan rainy season is a significant factor off Barbados.[17]

Barbados researchers have done some work on billfish. Billfish abundance appears to have two seasonal peaks, one during April/May and another during October/November. One sampling study has shown the following species composition during December-April: blue marlin (54 percent), sailfish (21 percent), white marlin (16 percent), and spearfish (9 percent).[18]

Barbados swordfish catch data provides some insights on seasonality. Fisheries dependent data must be used with caution, but at this time it is virtually the only available information on swordfish seasonality in the waters off Barbados.

Barbados data: Data available from 1989-91 operations show catches peaking in September and October and at very low levels from March to August, except May (appendix C3b).[19] More current Barbados swordfish catch data shows a similar pattern. The peak catches are reported in the first half of the year and, while highly variable, lower catches are common from May to September (appendix B7e). Other reports have noted similar, but not identical patterns with the best results reported in the colder months (appendix B7a-b).

Grenada data: This is similar to the seasonal patterns reported by Grenadian fishermen to the west of Barbados (Grenada, appendix B3 and B6).

Cuba: The ocean area around Barbados is one of the few areas in the Wider-Caribbean that Cuba has deployed its commercial longliners. The Cuban deployment since 1990 has been highly seasonal, only during the fourth quarter and reported small swordfish catches.

Asian countries: All of the three Asian longlining countries have reported fishing operations around Barbados. These operations, however, did not target swordfish and show no discernable seasonal pattern. Some notable swordfish catches were reported by these countries in all four quarters (appendix C3g).

Trade data also provides some indicators as to seasonality. Almost all Barbados swordfish shipments abroad go to the United States. U.S. imports of fresh swordfish thus offer some insights on seasonality. As fresh swordfish is a highly perishable product, it is

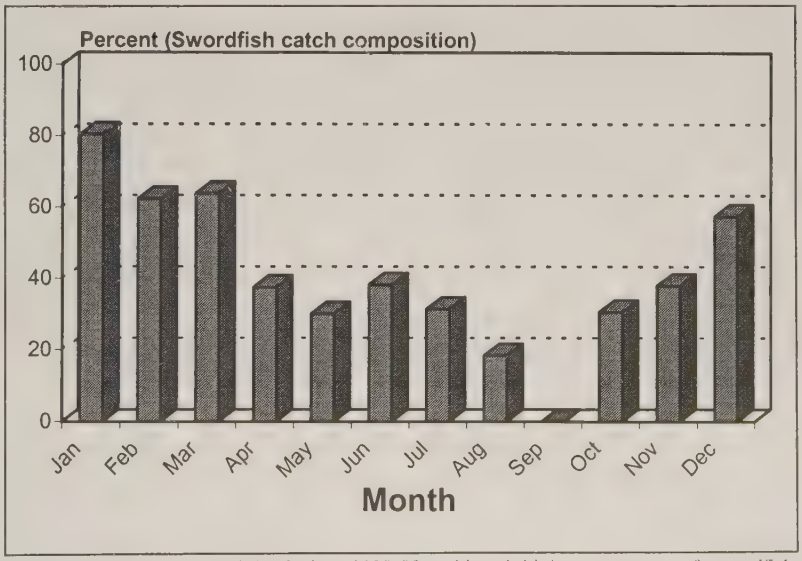

Figure 9--Experimental trials during 1988-89 achieved high percentage of swordfish, specially from December to March.

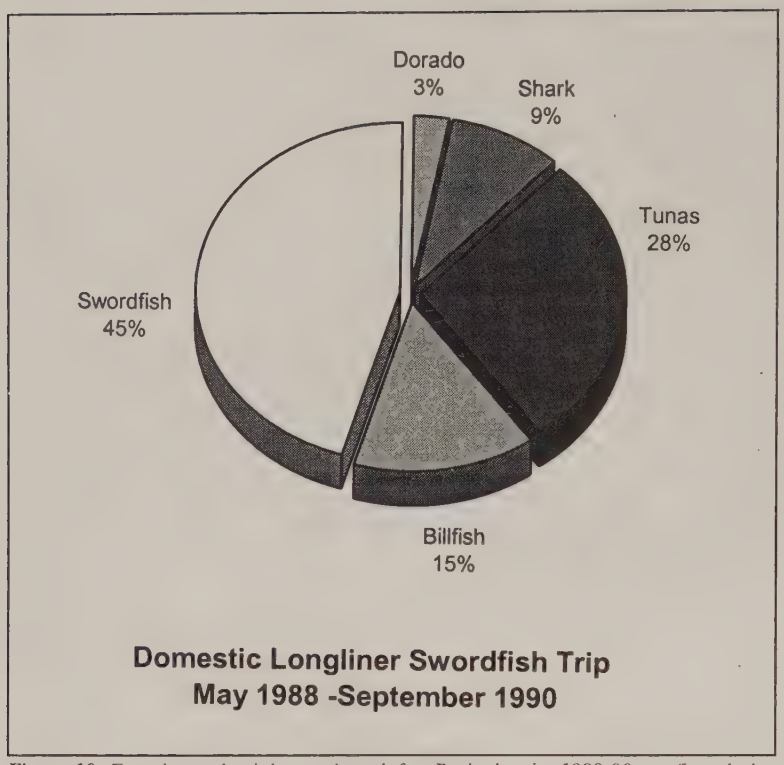

Figure 10--Experimental trials conducted for Barbados in 1988-90 confirmed that substantial quantities of swordfish can be taken around the island.

normally shipped within hours after landing. The quantities involved from Barbados are large enough to denote seasonal patterns of some validity. U.S. imports from Barbados show a marked seasonality. Since 1995 when significant shipments commenced, most of the fish has been shipped in the first half of the year, commonly from February to April, although there are substantial annual variations. All of the peak months were in the first half of the year with only one exception (appendix E2c).

C. Stock status

Researchers in Japan, Spain, the United States, and other countries have conducted genetic studies which have demonstrated that swordfish in the Mediterranean and south Atlantic are genetically different from swordfish in the north Atlantic.[20] This means that they are different populations which should be reflected in the management regime. There are, however, varying levels of exchange between these different populations. Researchers at the Spanish Instituto Nacional de Oceanografía (INO) and the University of South Carolina (USC) are now attempting to assess genetic variability within the north Atlantic. They plan to sample larval swordfish from the Caribbean and other areas of the western north Atlantic. The INO, University of Miami (UM), and USC are especially interested in obtaining larval and juvenile swordfish samples from spawning off the eastern coast of Barbados.[21] The results of these tests will provide important information on spawning and stock structure from an area close to the theoretical 5° N latitude line separating the theorized north and south Atlantic stocks.

D. Abundance

Limited data in the published literature exists on longline catch rates in tropical Atlantic waters and this is especially true of the Caribbean. Actual catch data, however, is readily available from ICCAT. Asian longline fishermen have reported some notable catches in the area around Barbados. The Koreans in 1979 took 10.7 t of swordfish in the

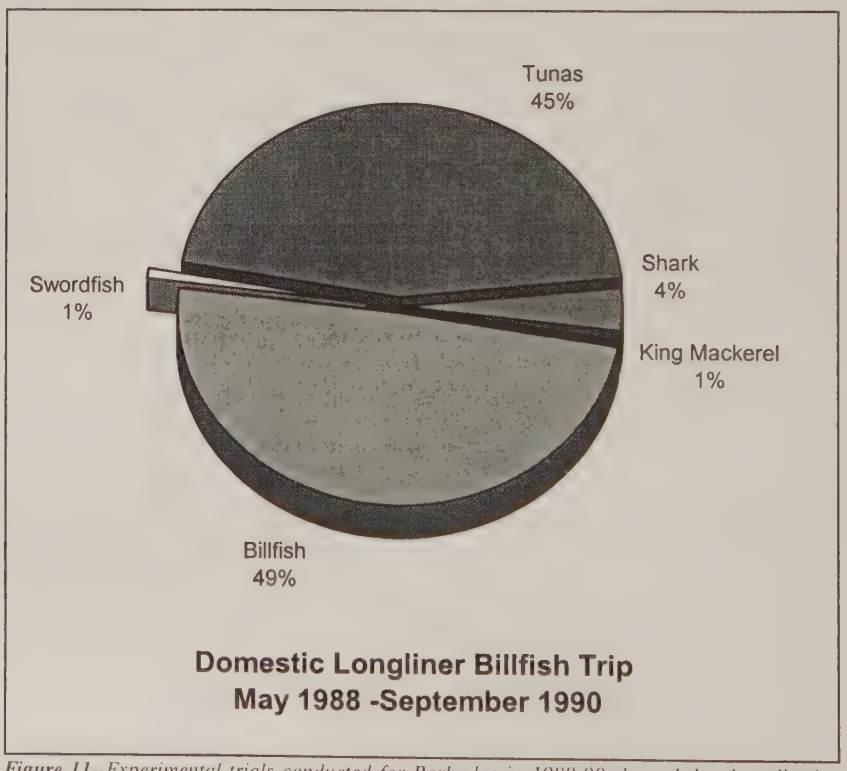

Figure 11--Experimental trials conducted for Barbados in 1988-90 showed that by adjusting fishing strategies that substantial billfish catches were possible.

Photo 5.--Barbados researchers compiled extensive data on longline yields in the southeastern Caribbean to assist fishermen entering the longline fishery. Dennis Weidner

third quarter and the Japanese in 1965 took 19.8 t in the fourth quarter (appendix C3g).

Available information on abundance of swordfish in the southeastern Caribbean was compiled by several studies prepared in the late 1980s and early 1990s as Barbados fishermen began to enter the commercial longline fishery. Barbados researchers compiled data from longline operations conducted by Barbadian and Grenadian fishermen as well as data compiled from test fishing campaigns contracted by the Barbados Government. Comparisons between the different groups were difficult because of the varying methods used to record the data on fishing effort and catches. The results were highly varied, but some of the fishing operations reported substantial longline catches (Caribbean Overview, appendix C2e), including swordfish (appendices B3a-b, B4, B5a-b and B7a-d). Researchers concluded that overall longline catch rates varied from 0.4-1.8 t per 1,000 hooks, 0.2-2.8 t per fishing trip (1-7 days).[22] Foreign fishing data compiled by ICCAT shows very substantial differences as to swordfish catches in the various ocean areas around Barbados. It is unclear, however, to what extent this is actual abundance or the results of the different fishing methods employed by the fishermen (Caribbean Overview, appendix D3-7). Test fishing by Barbados vessels demonstrate the degree to which species composition can be affected by varying fishing strategies, such as the time of the set or the depth (appendix B5a). Individual Barbados longliners report widely varying results (appendix B9).

E. Migrations

The authors have little information about migratory movement of swordfish immediately around Barbados. Swordfish have been tagged and recovered in the northeastern Caribbean south of Puerto Rico and the Virgin Islands within the Antillian Arc and north and east of the Lesser Antilles out into the Atlantic. The fish appear to be moving seasonally up to rich feeding grounds off New England and Canada to feed and return back to the Wider-Caribbean to spawn. (See "Caribbean Overview" and appendix Caribbean Overview, appendix C3.) The lack of tagging data off Barbados itself provides few clues as to the migratory behavior of the fish around the island. One fish was tagged southeast of Barbados at 11°N,57°W (R274341 in Caribbean Overview, appendix C3). The fish was retrieved at an unknown interval south of Cape Hatteras having grown from 14 kg to 79 kilograms. This is consistent with the movement of other tagged fish in the Wider-Caribbean. Notably, most of the swordfish tagged west of 56°W in the wider Caribbean were recaptured west of 56°W off the United States and Canada. While there are some exceptions, most of the fish tagged east of 56°W, like the fish tagged southeast of Barbados, were retrieved well to the east of that line beyond the Grand Banks. The limited number of tag returns makes it impossible to draw any firm conclusions about the east-west patterns in swordfish migrations. The preliminary observations, however, are intriguing.

III. Grounds

A. Oceanography

The surface waters of the Caribbean are thermally stable, stratified, and relatively deficient in nutrients, except for isolated areas of upwelling. As a result there is little opportunity to replenish nutrients in surface water layers with nutrients from greater depths. Primary productivity throughout the Caribbean is thus generally low and relatively constant. Marked seasonal changes characteristic of fisheries in more temperate latitudes do not occur in the Caribbean. Some notable changes in primary productivity, however, have been observed in waters off Barbados and Jamaica. Product's peaks off Barbados have been noted during the spring and from May to September.[23]

The principal oceanic input to the Caribbean from current transport occurs through the Lesser Antilles. Venezuelan researchers report that the main inflow into the Caribbean occurs between Dominican and St. Vincent (21.5 Sverdrups).[24] Other researchers report stronger current flow more to the south.[25] NOAA during 1991-94 conducted 10 cruises during different seasons to assess the current structure and water mass properties in the southern passages between the Caribbean and Atlantic from Dominica south to Trinidad.[26]

Currents off Barbados flow in a west-northwest direction for most of the year. The island effect on those currents induces gyres on the western side of the coast--anti-cyclonic in the southeast and cyclonic in the northwest. These gyres gradually weaken on their way west as the current moves toward the Caribbean passages. The gyres are affected by water accumulating along the barrier created by the Caribbean sill and the Lesser Antilles islands. During the summer the gyres can be characterized by areas of low salinity water of Amazonian origin. Some of the gyres may be 325-500 km across. As they approach the islands of the Lesser Antilles, the gyres begin to break up, causing some upwelling at the periphery.[27]

One fisherman with considerable experience in Barbados believes that current patterns off Barbados have shifted over the years. He remembers as a young man seeing whole trees and debris coming up from the South American rivers, but this is now much rarer. He also remembers a different species composition. He recalls very large concentrations of bonito which are now rarely seen. The abundance of jacks, sprats, bait fish, and other species has also been altered.[28] Of course a variety of factors could cause such changes, but changing current patterns is one possibility.

B. Topography

Barbados is the most easterly island of the Lesser Antilles. It is located to the east of the St. Vincent and to the northeast of Trinidad and is thus not precisely located in the Caribbean. Barbados is connected with the other Windward Islands of the Lesser Antilles by a doughnut-shaped underwater ridge. Barbados is on the eastern end of this doughnut-shaped ridge and St. Lucia, St. Vincent and Grenada are on the western side. Depths on this ridge range from 200-1,800 meters. This underwater ridge encircles the Tobago Basin with depths exceeding 2,000 meters.

The island of Barbados is largely of coral formation, pushed out of the sea by volcanic activity. The island has a varied coastline and mostly developed rolling countryside covered with sugar cane. Along the west coast, there are coral fringed white sand beaches. Along the east coast of Barbados a lively surf, blown briskly by the strong and constant Trade Winds, assault a sometimes dramatic rocky shore. The constant breeze of the Trade Winds gives Barbados a mild, pleasant tropical climate. Barbados is mostly a flat coral island, but there are rolling hills and many deep rifts and gullies, with an interesting distribution of plants and wildlife. Within the Barbados coral core there is a vast array of caves and underground lakes which provide an excellent supply of fresh water that is amongst the purest in the world. Geologically Barbados is unique, being actually two land masses that merged.

Barbados fishermen only have access to a relatively small shelf area. The 320 square km of shelf falls off steeply to deeper, less productive waters. The 200-m isobath is only about 2-14 km from any point along the coast.

C. Fishing grounds

The Barbados Exclusive Economic Zone (EEZ) is about 48,800 square km, of which only about 320 square km is shelf. The small shelf area in part explains the limited catch of demersal species. Two of the most important fishing grounds for Barbados are London Shallows and Trader Banks.

1. Artisanal

Artisanal fishermen operating small boats are restricted to inshore waters. Almost all artisanal fishing tales place within 30 km or less of the coast.

***Photo 6**.--This small Barbados longliner is leaving its base at the Bridgetown fishing port for operations off the southeastern coast within the islands' 200-mile EEZ. D. Weidner*

Most of the artisanal activity is conducted along the west coast as the exposed Atlantic eastern coast has much rougher sea conditions.

2. Commercial

Barbadian ice boats fish mostly in Barbadian waters, but can venture further off the coast than the artisanal fishermen with their small boats. The addition of ice boats to the fleet in the late 1970s significantly expanded the range of the fleet and the grounds utilized by the fishermen. The vessels usually make trips of about 3-5 days, although trips of a week or more are not unknown. Ice boats fish throughout the Barbados 200-mile EEZ, although operations to the east of the island in the open Atlantic are limited.[29] There is also some activity off neighboring islands. Operations are more extensive to the west and south of the island where ocean conditions are safer.[30] The southeastern coast where the island's populations is centered also offered the best ports, at Bridgetown and Oistins. Port improvements at Skeete's Bay and Conset Bay may result in expanded operations off the western coast, although these ports, even when work is completed will not offer adequate facilities for the longliners. The fishermen operate off the Windward islands (especially St. Lucia and St. Vincent). The ice boat fishermen also operate as far south as Trinidad and Tobago and Grenada.[31] Trinidadian waters, especially grounds off Tobago, have become important to the Barbadian fishermen because the ice boat fleet has expanded in recent years. The fishermen have, however, experienced difficulties obtaining access to Trinidadian grounds. A bilateral agreement was signed in late 1990 addressing this problem, but lasted only 1 year. (See: "International Relations.") Some Barbadian vessels have been reported as far north as the southern coast of the Dominican Republic.[32]

Barbadian longliners are believed to operate mostly within the Barbados EEZ and Atlantic waters east of the island. Unlike the islands of the Lesser Antilles, Barbados is situated to the east--outside the Caribbean arc. This affords Barbados a particularly large EEZ, especially on the eastern and northern coast facing the open Atlantic. A substantial part of the Barbados longline effort is deployed within the country's extensive 200-mile EEZ.

Figure 12--Several countries have operated longliners in waters around Barbados, ICCAT square 1055. Currently Cuba, Taiwan, and the United States are active.

The limited operational range of the Barbados fleet is in primarily determined by three factors.

Vessel size: Barbados longliners are relatively small boats. Given the small size of the boats, operations far offshore are not advisable (appendix A2c).

Fresh fish: Landing fresh fish limits the operational range of the vessels. Generally speaking, fishermen want to land fish before it is 2 weeks old. Thus fishing trips are restricted to a maximum of about 15 days.

Crew preferences: Barbados fishermen don't like long trips with extended periods away from friends and family. Crews don't want to stay out beyond 2 weeks.

Barbadian longline fishermen, except those on the largest boats, rarely conduct operations beyond 500 km of the island. Fishermen do not normally fish south of 5°N. Much of the longlining conducted outside the island's EEZ occurs to the north and east of the islands.[33] Barbados fishermen do not have access to the fishing zones of the islands to the west of Barbados. The authors do not, however, have access to data detailing precisely where the Barbados longline fishermen are operating.

Some data is available from foreign fishermen on their catches in ocean areas around Barbados. The information reported here is for the ocean area immediately around Barbados (ICCAT square 1055). Data on adjacent areas is also available (Caribbean Overview, D3-8.). The catches reported are remarkable for the variation among countries. This is in part because of the different target species and methods employed. The Asian longline fishermen, for example, have targeted different species of tuna over the years.

Cuba: The Cubans since 1984 have been active off Barbados. While most of their fleet works off West Africa, there is some effort in the Atlantic east of Barbados (appendix C3g).

Japan: The Japanese began fishing tuna around Barbados in 1959 and operations by 1964 were extensive and reported year-round. Swordfish bycatches reached a record 19.8 t in 1964. Operations became more sporadic in the 1970s. The last Japanese catches were reported in 1989 (appendix C3g).

Spain: The large Spanish fleet does not operate in the Wider-Caribbean.

Taiwan: Taiwan has been active in the Wider-Caribbean, but first reported catches around Barbados in 1968. Annual operations became more common beginning in 1985 and intensified in 1991. The record swordfish catch of 7.3 t was reported in 1991 (appendix C3g). Much of the Taiwan longline catch off Barbados is believed to be transhipped through Port of Spain, Trinidad.

United States: The best indicators for appropriate swordfish grounds can be derived from the results reported by U.S. fishermen because they were actually targeting swordfish. U.S. fishermen report good swordfish catches both in the Atlantic east of Barbados and in the Caribbean to the west of Barbados.[34]

3. Recreational

Fisheries is one of the many attractions which draws tourists to Barbados. The recreational fishery in Barbados targets barracuda, tunas, wahoo, dorado, and billfish. There is a fleet of cabin cruisers available for charter.[35] Most charter fees include drinks, all tackle and bait. The island's coral reefs provide excellent snorkeling and scuba diving, amid idyllic undersea gardens of waving fans and multicolored tropical fish. The two principal ports (Bridgetown and Oistins) are located along the southern coast of Barbados. Recreational fishing is conducted mostly along the island's southern coast within about 25-50 km of shore.[36]

Photo 7.--The artisanal fleet is made up of a large number of small multi-purpose boats deploying a variety of gear. It is one of the most modern artisanal fleets in the Caribbean. D. Weidner

IV. Fleet

A. Artisanal

Barbadian artisanal fishermen have for over 200 years utilized highly unstable sail boats based on the design of the longboats used by the British man-o-wars during the Napoleonic Wars. The boats varied in size from about 6-8 meters with the larger boats generally found along the islands leeward (western coast). They were ballasted by cast iron and rocks which were moved as needed. It was not until the 1950s that more modern boats and outboard motors were introduced.[37] This significantly increased the fishing potential.

Two different types of boats are currently used in the artisanal dayboat fishery.[38] The day boats or moses have traditionally dominated the artisanal fishery. Most of the dayboats are constructed from wood, but there are now also some fiberglass boats.[39] The artisanal fishing fleet increased significantly during the 1980s. The number of artisanal day boats increased from 590 boats in 1983 to 700 boats in 1988. The number subsequently declined to only 445 boats in 1993. Larger launches or ice boats capable of longer commercial trips have become increasingly important during recent years (appendix A1), partially explaining the decline of the day boats.[40] The fleet in 1993 consisted of about 275 moses and 350 launches.[41] Another estimate in 1995 reported about 355 moses and 300 launches.[42] While the commercial ice boats are a small proportion of the fleet, about 10-12 percent, these larger vessels account for a substantial portion of the overall catch.

Moses: The traditional boats used in the fishery are

Photo 8.--The Barbados commercial longline fleet is the largest and most advanced in the eastern Caribbean. The vessels are based at the Bridgetown fishing port. D. Weidner

Photo 9.--This 13-m longliner, the "Sugar 'n Spice," is typical of the small vessels deployed by Barbados fishermen. D. Weidner

small inshore dinghies called "moses" by the local fishermen. The moses are mostly about 3-5 meters (m) long, but some may reach 6 meters. The moses were formerly equipped with oars, but most are now outfitted with outboard motors. They are used in reef and various inshore fisheries.

Launches: Launches were introduced during the 1950s. The first launches were heavily built wooden vessels from 6-9 m with small inboard motors of 10-45 horsepower. Beginning in the mid-1960s larger launches up to 11-12 m were introduced with more powerful engines of up to 120 horsepower. The average size of the launches have steadily increased.[43] Some launches by 1999 exceed 12 meters.[44] They are mostly used in the fisheries for flyingfish and large pelagics. They are sometimes called day boats, as they normally are deployed for day trips.

B. Commercial

The Barbados commercial fishery has deployed three types of vessels:

Shrimp trawlers: Shrimp trawlers were the first commercial vessels deployed by Barbados. The vessels were used for distant-water fisheries off Brazil and the Guianas during the 1960s-70s, but phased out as Barbados lost access to those grounds. Barbados has no significant shrimp grounds in which large trawlers could be deployed. A few were converted to longliners.

Ice boats: Artisanal day boats traditionally dominated the Barbados fishery, but larger ice boats capable of longer trips have become increasingly important during the 1980s (appendix A1). They are normally deployed for 3-5 day trips. About 93 ice boats were active in 1995.[45] Most of the ice boats have wooden hulls, but a number of fiberglass vessels are also deployed along with a few steel and ferrocement vessels. One local source says most of the ice boats are fiberglass.[46] The first ice boat was introduced in 1978. The earliest ice boats ranged mostly from 12-15 meters, although a few were smaller. These early boats were existing boats which had been modified by fitting an insulated box aft of the midships superstructure. Some of these modified boats

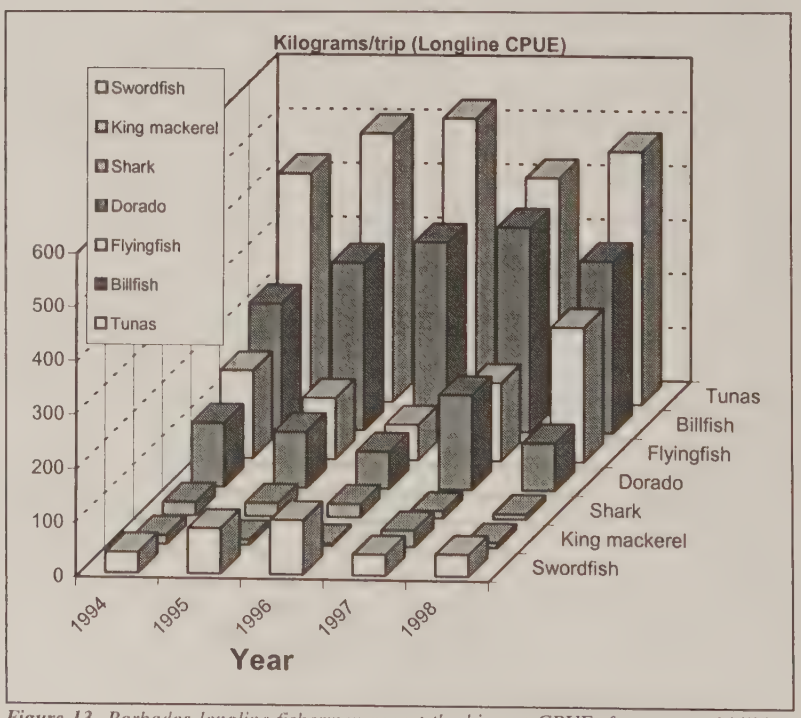

Figure 13--Barbados longline fishermen report the biggest CPUE, for tuna and billfish. There can be significant fluctuations from year to year.

Photo 10.--The Barbados longline fleet is made up primarily of small boats, but there are also a few larger longliners. Dennis Weidner

were reportedly lengthened indiscriminately, adversely affected the vessel's structural integrity. The fishermen gradually introduced larger, purpose-built boats with either wooden or fiberglass hulls during the later 1980s. The improved vessels also featured amenities for the crew. Some of the boats are now reportedly as large as 18-21 m in length, although most are under 20 meters.[47] They have insulated holds with capacities of 5-15 t for fish and ice. These vessels are equipped with inboard engines, some as large as 225-240 horsepower. They are used primarily to catch flyingfish and large pelagics.

Longliners: The first Barbados longliner was reportedly the 12 m *Dragon Bay*.[48] It was reportedly active in 1988, but the authors are unsure just when it initiated operations. The current Barbados longline fleet in mostly composed of vessels acquired in the 1990s (appendix A2b). One report indicates that by 1996 the fleet consisted of about 18 vessels. The DF reported a fleet of nearly 30 longliners in 1999, although details are not available on the number being actively deployed. Many of the vessels are ice boats and older vessels refitted for longlining.[49] Most are greater than 12 m in length and equipped with inboard diesel engines. The first Barbados longliners were mostly 11-13 m vessels. Somewhat larger 13-15 m vessels are now more common and several larger longliners (17-23 m) make up the Barbados fleet--although the vessels vary greatly as to how actively they are deployed.

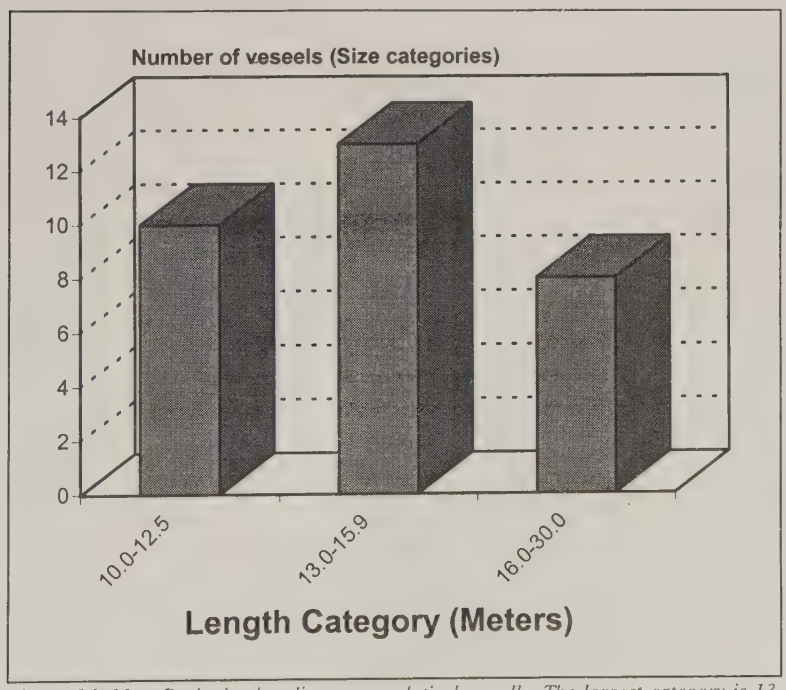

Figure 14--Most Barbados longliners are relatively small. The largest category is 13-15.9 meters.

Small: Barbados fishermen deploy about 25 small longliners. The longliners range from about 11-15 m in length, but there are a few larger vessels (appendix A2c). The first longliners were 11-13 m vessels, but in recent years most new longliners have been 13-15 m in length, although several larger vessels have also been acquired. The Barbados longliners are a varied collection of vessels, but most have ice holds. Some are converted commercial shrimp trawlers. A few are purpose-built wooden vessels produced by local shipwrights. Most of the vessels have been acquired in the 1990s. A typical small longliner might have a fiberglass hull, a 5 t ice hold, an inboard diesel engine, and living space for a crew of three.[50]

Large: The two largest longliners (*Colleen Cheramie* and *King of Kings*) are

described below. One sank and the other is currently idled and for sale. Both were deployed unsuccessfully out of Bridgetown and then operated under leasing arrangements off Brazil. There are two other longliners over 20-m and four longliners in the 17-19 m category (appendix A2c). The larger longliners have steel hulls, but there are also some GRP hulls in this category. Several of these vessels have operational problems, although the authors do not have information on all the vessels. The largest operational longliner is the 23-m *Neptune Goddess*, but it is rarely deployed. Barbados officials believe, however, that vessels exceeding about 18 m are not well suited for the Barbados fishery where trips tend to be relatively short.[51]

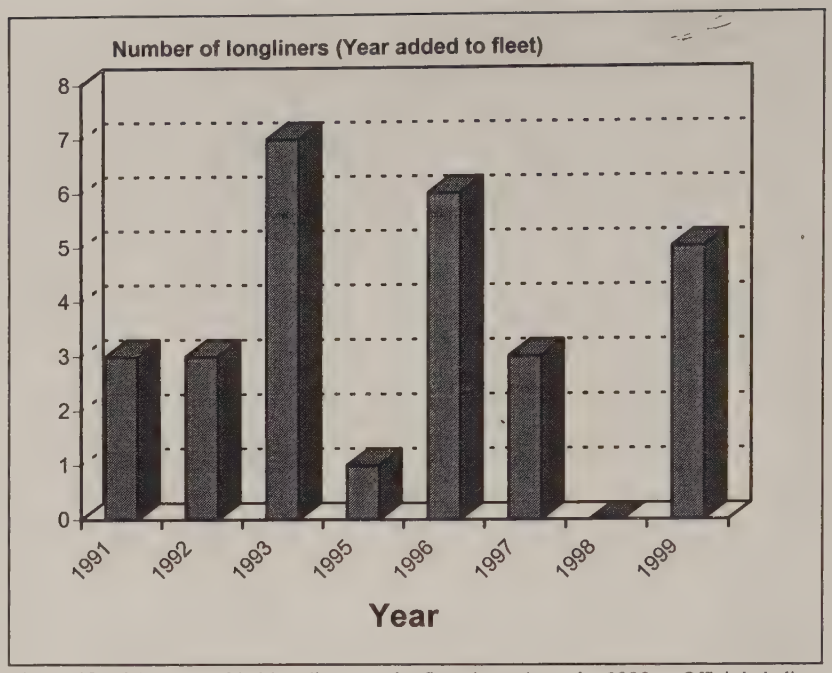

Figure 15--Fishermen added longliners to the fleet throughout the 1990s. Officials believe that the expansion is now slowing.

Barbados has since the 1960s deployed a small number of commercial fishing vessels. The primary commercial activity, however, has shifted in recent years. Shrimp trawling dominated the commercial fishery during the 1960s-70s, but ended by the early 1980s when the fishermen were unable to maintain access to grounds off the Guianas. Commercial fishermen in recent years have initiated a new fishery, longlining for tuna and other oceanic pelagics.

1960s: Most of the commercial vessels during the 1960s were shrimp trawlers. The commercial fleet at its peak consisted of more than 30 trawlers in the mid-1960s.[52] The fishermen fished grounds off northern Brazil and the Guianas.

1970s: The shrimp trawler fleet declined in the late 1970s because of loss of access to distant-water grounds. (See: "International relations.") Fishermen began introducing ice boats into the domestic fishery. The *Run-away* was registered in 1970, although the authors can not confirmed that it was, at the time, a longliner (appendix A2b). The *Run-away* was a 12-m GRP vessel. Most of the early Barbados longliners were of similar size (11-13 m) and built of GRP or wood.

Early 1980s: Press reports indicated that the remaining Barbadian shrimp fleet of 14 trawlers was idled in 1980 because of lack of access to distant-water grounds. Some vessels were destroyed by storms, some sold, and others offered to the Barbados Defense Force for use as patrol vessels.[53] Ice boats steadily gained in

Photo 11.--The 21-m "Margrace 1" is one of the larger longliners in the Barbados fleet. Dennis Weidner

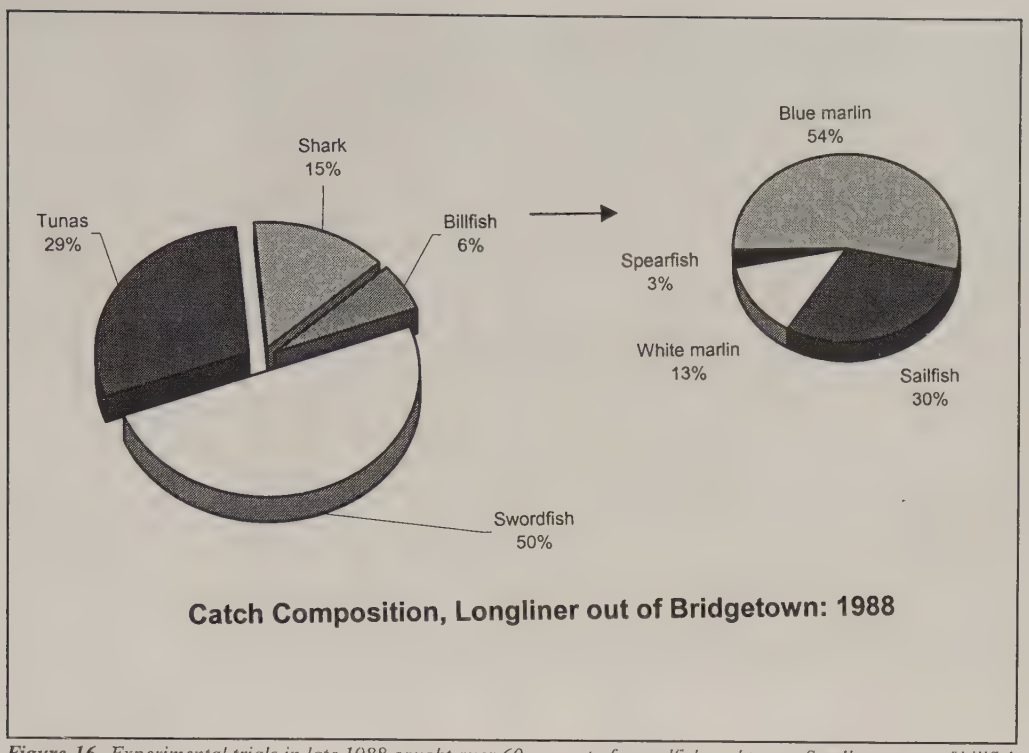

Figure 16--Experimental trials in late 1988 caught over 60 percent of swordfish and tuna. Small amounts of billfish were taken--mostly blue marlin.

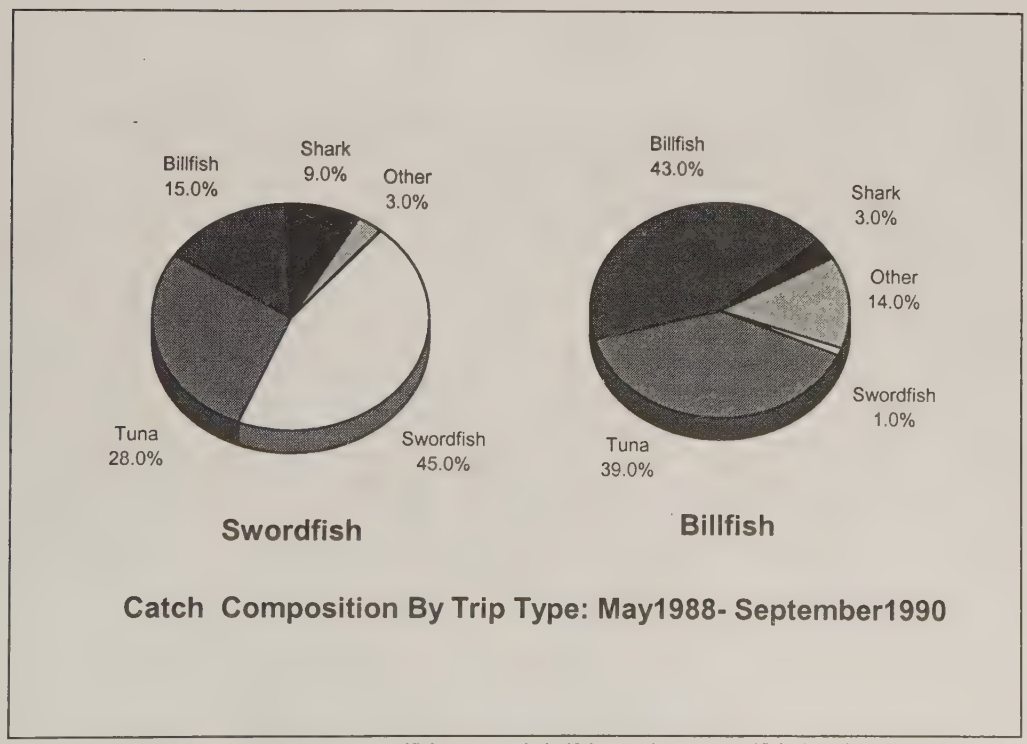

Figure 17--Test fishing showed that on swordfish sets nearly half the catch was swordfish, but virtually no swordfish was taken by billfish sets. Tuna were taken in both the swordfish and billfish sets.

Photo 12.--The Barbados longline fleet in 1999-2000 was composed of about 30 small longliners. Dennis Weidner

importance for the domestic fishery. The *Cygnus Ranger* was registered in 1982, although the authors can not confirm that it was, at the time, a longliner (appendix A2b).

Mid-1980s: Some of the larger ice boats in the 1980s began to experiment with longlines. A few boats began to install small reels to deploy short longlines. The resulting catch was enough to stimulate interest in entering the longline fishery.[54] Fishermen also noted the activities of American longliners transhipping through Bridgetown and other Caribbean ports, further increasing interest in the longline fishery. Two current longliners (*Sugar n'Spice* and *Challenger*) were registered in 1986-88 (appendix A2b).

1988: The longliner *Sea Breeze* was acquired in 1988. One unconfirmed report suggested Barbadian companies were considering the purchase of other longliners to diversifying the island's highly seasonal fishing industry by targeting offshore tuna and swordfish. The number of ice boats reached 80 in 1988 (appendix A1). A few ice boat fishermen refitted their vessels for longlining.[55] The DF sponsored test fishing to acquire data for local fishermen on the potential of Barbados waters. Data was collected in 1988-89 from the *Taygits* and *Kristin Lee* and *Janice Ann* (two U.S. longliners).[56]

1990: ICCAT officials reported a few Barbados longliners targeting swordfish.[57] The local fishermen complained that U.S. import regulations, especially the FDA mercury guidelines, made it difficult for the Barbados fishermen to market their catch in the United States, thus discouraging the fishermen from targeting the species.[58] Some consultants suggested that Barbados fishermen entering the longline fishery initially install relatively small longlines (about 3 km) on existing vessels rather than invest in costly dedicated longliners.[59]

1991: Barbadian fishermen initiated a major effort to enter the fishery. Fishermen acquire three longliners (*Heidsue*, *Oriana*, and *Sihor III*) in 1991 and most of the current longliners were acquired in succeeding years from 1992-96. Several of the Barbados longliners, however, were reportedly broken down or under repair in early 1991.[60]

1992: Barbadian fisherman Jonathan Morgan

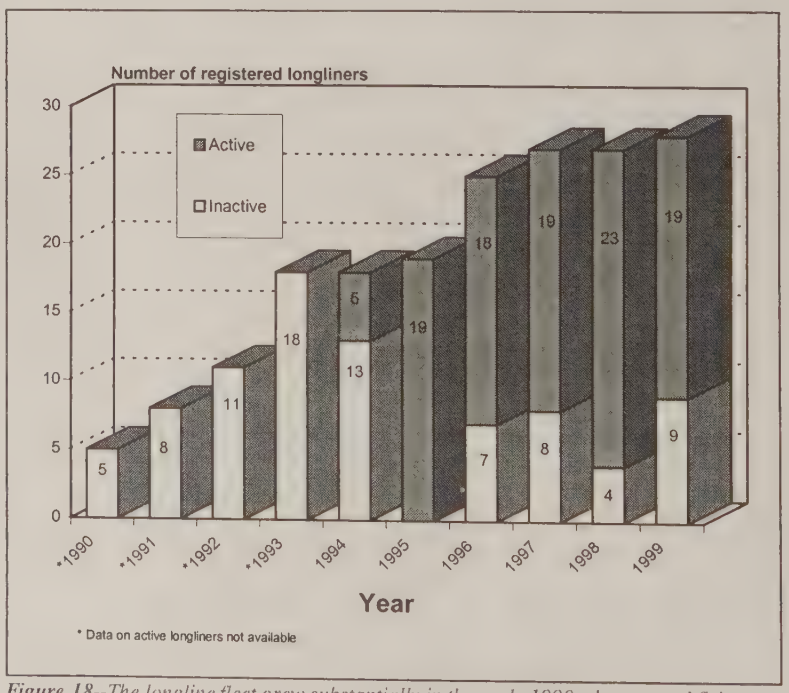

Figure 18--The longline fleet grew substantially in the early 1990s, but several fishermen reported problems in the later years of the decade and rarely deployed their longlines.

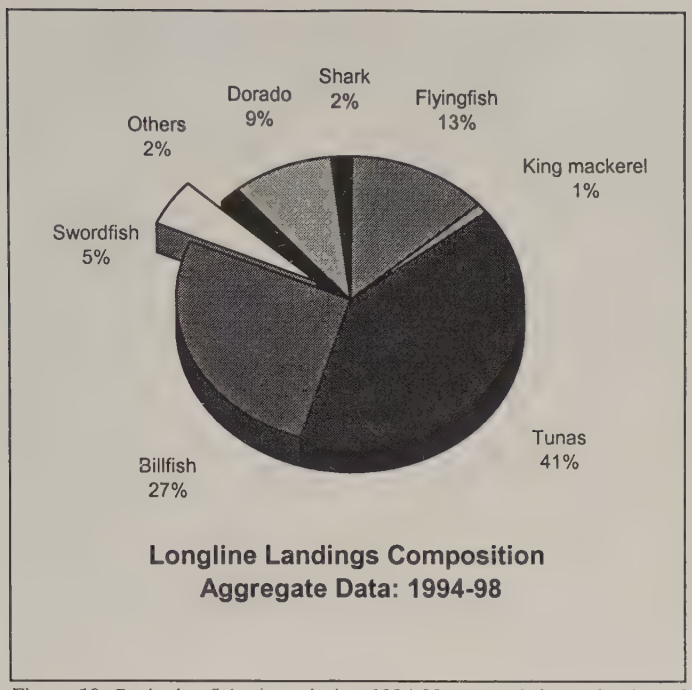

Figure 19--Barbados fishermen during 1994-98 reported that only about 5 percent of their catch was swordfish.

speculated that if the Japanese could conduct successful operations out of St. Maarten and the Taiwan fishermen out of Trinidad, "then a Barbados-owned and operated could be successful." The Barbados company Fins & Fathoms purchased two large vessels, the *Colleen Cheramie* (27 m) and the *King of Kings* (24 m) in the United States and refitted them for longlining and registered them in 1993 (appendix A2b).[61] These are the two largest longliners ever deployed in Barbados, but neither was a purpose built longliner. Other fishermen acquired three other longliners (*Danielle Amand*--15 m, *Destiny*--15 m, and *Neptune Goddess*--23 m). Two of these vessels were the first steel hull longliners added to the Barbados fleet. The *Neptune Goddess* was one of the largest fishing vessels registered in Barbados and at nearly 23 m is currently the largest active Barbados longliner. The authors are unsure about its initial deployment. Barbados officials report, however, that by 1999, it was rarely deployed and such large vessels are not appropriate for the Barbados fishery which usually involve short trips.[62]

1993: The ice boat fleet by 1993 had declined to only 68 vessels (appendix A1). The Barbados Government reported a fleet of 6 longliners in 1993.[63] Current DF statistics suggest 11-18 longliners may have been active (appendix A4). Fins & Fathoms deployed their two large longliners.[64] Several additional smaller longliners (*Aliva III*, *Endeavor*, *Mark I*, *The Triumph*, and *Zelwood II*) were also added to the fleet. The number of new vessels shows the level of interest in the fishery. This suggests that some early Barbados longline fishermen were doing quite well.

1994: Fins & Fathoms reportedly experienced disappointing results with its two large longliners. One local source noted crew problems. No new vessels were added to the fleet in 1994 after the substantial buying spree in 1992-93.

1995: Fins & Fathoms in late 1995, because of disappointing results from Barbados-based operations, decided to deploy their two large longliners off Brazil in leasing arrangements with companies there.[65] One fisherman added the *Lucky Lady* to the fleet (appendix A2b).

1996: Interest in longlining intensified and six longliners (*Against the Odds*, *Commander*, *Gricel-S*, *Juma IV*, *Kams*, and *Sea Sprite*) were added to the fleet in 1996. The two Fins & Fathoms longliners reported little success in operations off Brazil, but few details are available. Several local sources confirm that interest in the longline fishery was intense during the mid-1990s.[66]

1997: Two new longliners (*Joan J* and *Mar Grace #1*) were added to the fleet in 1997 (appendix A2b). The *Mar*

Photo 13.--Barbados longline fishermen rely very heavily on tuna. Swordfish makeup only a small part of the longline catch. Chris Parker.

Photo 14.--Some of the larger Barbados longliners, like "Blue Runner," have not proven profitable to operate and are now rarely deployed. Dennis Weidner

Grace #1 at 21 m was one of the larger longliners deployed in Barbados.

1998: Some boat owners experienced difficulty hiring captains with needed fishing skills.[67]

1999: A University of the West Indies researcher in 1999 estimated that there were about 11 active longliners of varying size targeting tuna, billfish, wahoo, and dorado--but rarely swordfish.[68] The FD listed 30 longliners in 1999, but some were not very active (appendix A2b). The *King of Kings* was, for example, moored in downtown Bridgetown with a large "for sale" sign. Three new longliners (*Carol-Ann, Emily Ann*, and *Jambar*) were added to the fleet (appendix A2b). These vessels were 13-15 m longliners, slightly larger than the first longliners which were 11-13 m vessels. All of the longliners acquired in 1997-99 have been GRP vessels.

2000: Some additional artisanal fishermen and investors are considering entering the longline fishery. While several fishermen and investors did so in the late 1990s, there is now more hesitation as the longline fleet is reporting mixed results. Some fishermen are reportedly doing well while others are struggling.[69] Fishery officials note that the growth of the longline fishery has come to a standstill.[70]

Information on individual Barbados longliners is:

Blue Runner: Some of the larger longliners in the Barbados fleet, like *Blue Runner*, have proven very costly to operate and are now not often deployed on fishing trips.

Colleen Cheramie: This 27-m vessel was built in the United States as an oil crew vessel in 1973. It was acquired by Fins & Fathoms in 1992 and refitted at Superior Shipyard for tuna longlining. It can hold 15 t of chilled fish and 10 t of frozen fish. The aft ballast tanks were cut up to hold fresh fish and her forward ballast tanks converted to a freezer for bait and bycatch. The vessel was reportedly deployed in the fishery during late 1993.[71] Fishing operations, however, proved disappointing and the owners moved the vessel to Brazil in 1995. The vessel has since sunk.

King of Kings: This 24-m vessel was built in the United States as a shrimp trawler, but later converted for use by the oil industry in the early 1980s. It was acquired by Fins & Fathoms in 1992 and refitted for tuna longlining. It has a hold with a 50 t capacity. The fish hold and freezer are both aft. It was reportedly deployed out of Bridgetown in the longline fishery during late 1993.[72] Fishing operations, however, proved disappointing and the owners moved the vessel to Brazil in 1995. Operations continued to be disappointing. The vessel was repossessed by the Barbados Development Bank which had financed the vessel. As of September 1999, it was moored in the middle of downtown Bridgetown by the Coast Guard wharf with a large for sale sign.

Lady Di: Offered to accept ICCAT researchers as observers in 1991.[73]

Mar Grace 1: This 21-m vessel is a converted shrimp trawler rerigged for longlining, but can be used as multi-purpose boat. It is one of the larger longliners in the Barbados fleet. It was purchased in 1997 and operated by the Simmons brothers. It has a 20 t ice hold.[74] The owners have not yet, however, been able to operate it at a profit. The vessel can carry 8,000 gallons of diesel which would permits operations off Suriname and Brazil.

Neptune Goddess: This 23-m longliner is currently the largest operational vessel in the Barbados longline fleet. It is, however, only occasionally deployed. Barbados officials believe that somewhat smaller vessels are better suited for Barbados because of the generally short trips usually conducted by fishermen.[75]

Photo 15.--A number of large modern recreational boats are available for sport fishing charters on Barbados. Chris Parker

C. Recreational

Barbados has a well developed and organized recreational fishing fleet. The industry is promoted by the Barbados Game Fish Association. The island has a fleet of cabin cruisers available for charter. Most charter fees include drinks, all tackle and bait. Several companies offer charters. The highlight of the deepsea sport fishing season is the Mutual/Mount Gay International Tournament last held April 24-25 and 27, 1999. This Tournament is held under International Game Fish association (IGFA) rules and regulations. While this is the most important tournament, several other sport fishing tournaments are held each year (appendix F). The BGFA encourages conservation and has minimum weights for all species in each tournament.

Barbados has a well developed and expanding recreational fleet. There are about 12 charter established boats.[76] The vessels vary from 9-15 m in length. The average boat is 11-13 meters. Representative boats are the 13 m *Cannon II* operated by Cannon Charters, the 12.5 m *Barracuda Too* operated by Steven Burke, the 12.5 m *Honey Bea III,* and the 11 m *Blue Marlin* and the 13-m *Idyll Time* operated by Blue Marlin Charters.[77]

D. Flag-of-convenience vessels

Barbados like several other Caribbean countries has an "open registry" or a policy of making flag-of-convenience registrations for foreign vessel owners. Such foreign owners are generally interesting in avoiding a demanding regulatory regime or reducing operating costs. There are, however, a wide range of reasons for wanting to flag their vessels in Caribbean and other countries making such registrations.[78] Barbados fishery officials feel strongly that foreign fishing vessels should not be included in such registrations and have succeed in convincing the Government to specifically exclude the foreign fishing vessels from Barbadian registry.[79]

Photo 16.--A few shipwrights in Barbados still work with wood, but more and more boats are being built with fiberglass. Dennis Weidner

Ocean Fisheries Ltd.: Another company, Ocean Fisheries Ltd., has reportedly built a few small longliners. One local observer indicated that they have built one 8.5 m longliner and in 1996 began construction of a 11-m vessel.

Some larger boats have been imported, mostly from the United Kingdom or the United States. About five of the small longliners have been imported as well as the two large longliners imported by Fins and Fathoms in 1993. These two larger longliners were used vessels purchased in the United States and converted for longlining in U.S. shipyards.

V. Shipyards

A. Vessel construction

The small artisanal fishing boats as well as many of the commercial vessels are built in Barbados. There are, however, no commercial shipyards. Local shipwrights have built some of the smaller boats used by commercial fishermen. Local yards have built a few small longliners. Most commercial fishing vessels are imported from the United States or other countries

Shipwrights: The wooden vessels are built by about seven local shipwrights such as John Wiltshire at Oistins and Luton Babb at Sherman's St. Peter. Most of their boats are the small artisanal vessels, but they have also built ice boats and longliners. About six longliners have reportedly been built by the shipwrights.

A T Builders: A T is located in Spring Garden and builds 22 and 40 ft boats.[80]

D I Manufacturing: DI is located in St. Johns and builds GRP boats. The company in 1999 was building 27 and 36 ft boats.

Fiberpol: One Barbados company, FIBERPOL, built fiberglass boats during the 1980s, using designs developed by local shipwrights. Fiberpol built artisanal launches, ice boats, as well as about five small longliners. The company has since closed its boat construction line and now focuses on furniture.

Most of the recreational boats are fiberglass and have been imported from U.S. shipyards.[81] A few, like the *Blue Marlin*, have been built in Barbados.[82]

B. Vessel maintenance

Vessel maintenance and service facilities are available in Bridgetown and Oistins. The Barbados Government operates slipways and a track system for hauling vessels out of the water. The owners then carry out the necessary repairs and service themselves or contract for it with local companies. These facilities can handle vessels up to about 15 meters. Barbados has no facility for servicing large vessels. Cargo and other large ships usually use facilities on Martinique or Trinidad.[83]

Photo 17.--These Barbados longline fishermen are using the offseason for maintemace and make needed repairs on their vessel. Dennis Weidner

Photo 18.--The longline fishermen stow their gear on the upper deck so that the main deck is clear and uncluttered. Dennis Weidner

Photo 19.--All of the longline fishermen know each other and there is a great deal of camaraderie among them. Dennis Weidner

VI. Fleet Operations and Gear

The artisanal fishery primarily focuses on flyingfish, although substantial quantities of dorado ("dolphinfish") is also taken. Artisanal, small-scale commercial, and recreational fishermen report small catches of tunas and related species, including billfish. The fishermen report notable catches of three billfish species (blue and white marlin and sailfish). Swordfish catches, however, are limited.

A. Artisanal

Artisanal fishermen report significant seasonal variations in their pelagic catches. Much of the seasonality is due to fluctuations in the flyingfish fishery, and to a lesser extent dorado, because these two species are normally such a large proportion of the overall pelagic catch. There appear to be two peak periods (February/March and April/May). Researchers speculate that the flyingfish migrate past St. Lucia and Barbados as they mature and spawn in the Atlantic Sargasso Sea north of the Caribbean. The juveniles are swept back to the Caribbean by prevailing currents.[84] The primary pelagic fishing season is traditionally from October/November to June, but with the addition of larger vessels during the 1980s, the fishermen were able to extend the season into July. As much as 40 percent of the fisheries catch in recent years has been taken during 2 months (May and June).[85]

Sampling of the artisanal fleet to determine catches of billfish and other oceanic pelagics has not been conducted for several years, primarily due to the lack of fishing activity.[86]

1. Day boat operations

The traditional boats (moses) used by artisanal fishermen through the 1950s were highly unstable and accidents resulting in drownings were reported annually. The DF now inspects Barbados fishing boats to ensure that they are seaworthy.[87] The fishermen primarily used scoop nets to scoop schooling fish out of the water. This method proved successful because the fish are attracted by floating objects, including boats, to lay their eggs. A variety of fish aggregating devices (FADs) are also used to help attract the fish, usually made by the fishermen out of natural materials when fishing for flyingfish.[88]

The Barbados artisanal fishery changed dramatically during the 1950s as drift nets and outboard motors were introduced. A particularly destructive hurricane which destroyed many of the existing traditional boats and Government subsidies to assist the fishermen replace their boats played a major role in the industry's modernization. Catch rates rose dramatically.[89]

The artisanal fishermen conduct two major inshore fisheries, deploying both small moses/dinghies and larger launches. Both are small open boats used for day fishing. The fishermen generally leave early in the morning and return the same day in the afternoon. Operations are thus conducted very close to port in shallow inshore waters. Some observers are concerned about the intensive effort on inshore grounds off Barbados and other Caribbean islands, believing that Government officials should take action to restrict the intense effort being deployed in some areas.[90]

Photo 20.--This Barbados longliner is equipped with a short and long range radar as well as communication antennas. Dennis Weidner

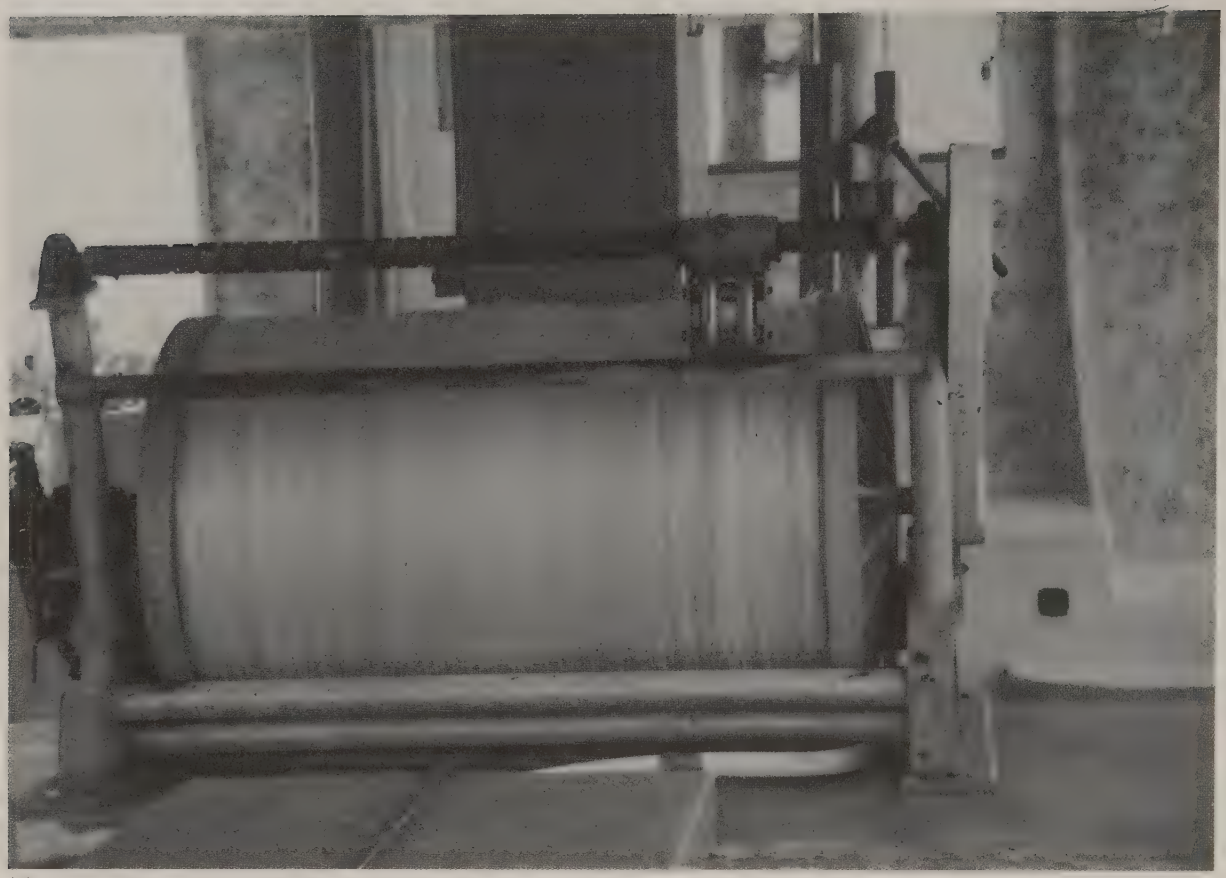

Photo 21.--Several of the Barbados longline vessels have large mainline reels capable of setting a line of over 80 km, but most of the fishermen make smaller sets of 25-30 km. Dennis Weidner

Photo 22.--The Barbados vessels vary greatly as to how the mainline reel and other equipment is arranged on the boat. Dennis Weidner

Moses/dinghies: Fishermen using the small moses conduct mostly reef fishing, primarily with traps. They depart in the early morning and return in the afternoon--early enough in the day to be able to sell their catch. The Barbados trap fisheries for reef fish, however, are relatively limited--in contrast to some other Caribbean fisheries where they can be a major part of the artisanal effort.[91]

Launches: Fishermen using launches also leave in the early morning. Trips are normally limited to 5-6 days. The most commonly used gear deployed from the launches is driftnets. Flyingfish move into surface waters early in the morning and the fishermen must leave early (1:30-2:00 am) to deploy their nets by dawn. They deploy short lengths of the driftnets over the bow of their boats. The fishermen use palm leaves or similar tree branches to attract the fish to the gillnets.[92] Fish are also attracted by suspending baskets of rotting fish into the water.[93] The nets are seldom more than 20-22 m long. The fishermen prefer the short nets so that they can be hauled in before attracting sharks.[94] When particularly large schools of flyingfish are encountered, the fishermen may resort to the traditional scoop methods. Hook and lines are also sometimes employed. They also troll with baited hooks for large pelagics on the way to the flyingfish fishing grounds. Fishermen might troll around drifting objects on grounds where they are targeting flyingfish and on the way to and from such grounds.[95] Species taken by trolling include dorado, kingfish, shark, sailfish, blue marlin, and yellowfin tuna. The fishermen primarily target flyingfish.[96] The fishermen are usually back by 4:00-5:00 pm.[97] Dorado, referred to as dolphinfish on Barbados and in the English-speaking Caribbean, are particularly important to the launch fishermen.[98] The fishermen report excellent dorado catches around floating objects they encounter.[99]

B. Commercial

1. Ice boats

Fishermen operating ice boats are able to fish at much greater distance from port, opening grounds previously unexploited by Barbados fishermen. The ice boat fishermen initially conducted trips of up from 5 to 10 days ranging as much as 500-650 km from the island. The iceboat fishermen are some of the few Barbados fishermen that can fish outside the EEZ. Recent reports from Barbados suggest trips of 10-14 days.[100] After their introduction in 1978, the ice boats radically changed the nature of the Barbados fishing industry. The ice boats greatly increased the catch capacity of the fleet. A ice boat normally lands 7-9 t of flyingfish each trip.[101] Landings may also include tuna, marlin, dolphin, and wahoo, although catches in recent years (except for flyingfish) have been poor. Ice boat fishermen do not normally take swordfish.[102] The ice boats greatly extended the operation limits of the fishermen--opening new areas to fish in. The ice holds enabled the fishermen to land a high-quality product, despite the extended trips.[103] The ice boats mostly operate out of Bridgetown and Oistins.[104]

2. Longliners

CFRAMP refers to Barbados longliners as small-scale industrial longliners.[105] The vessels are owned and operated by Barbadians.

Trips: The small longliners operating off Barbados generally make 4-7 day trips. Some of the larger boats may stay out for 2 weeks, but this is less common.[106] Longliners landing fresh fish are limited to trips of about 2 weeks because of the need to get the fish caught early in the trip back to port in acceptable condition.

Photo 23.--The mainline on the reel spools out through these guides referred to as a level wind. They help to insure that the reel rewinds evenly as the mainline is retrieved. Dennis Weidner

Photo 24.--There is a great deal of work to be accomplished before a longliner can set out on a fishing trip. Dennis Weidner

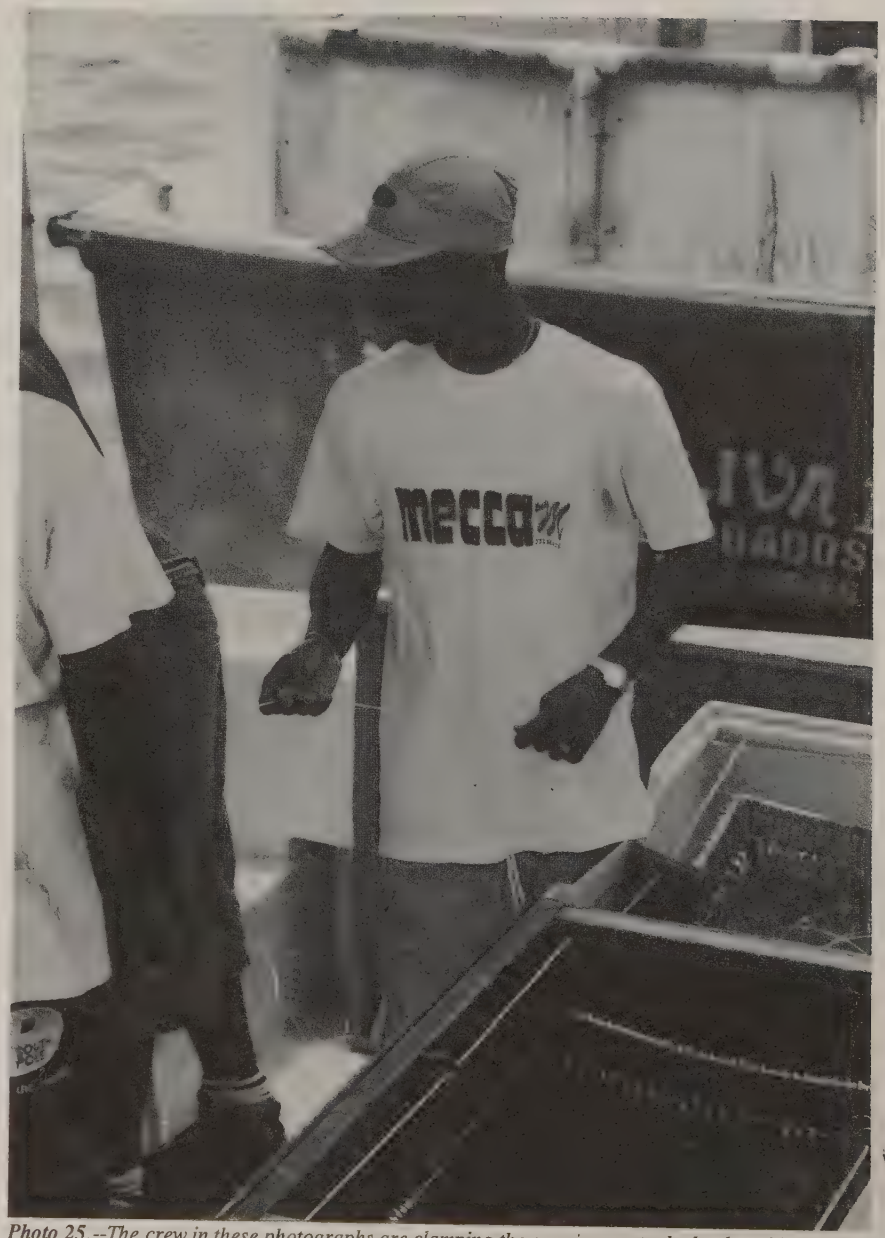

Photo 25.--The crew in these photographs are clamping the gangions onto the hook and leaderline. Dennis Weidner

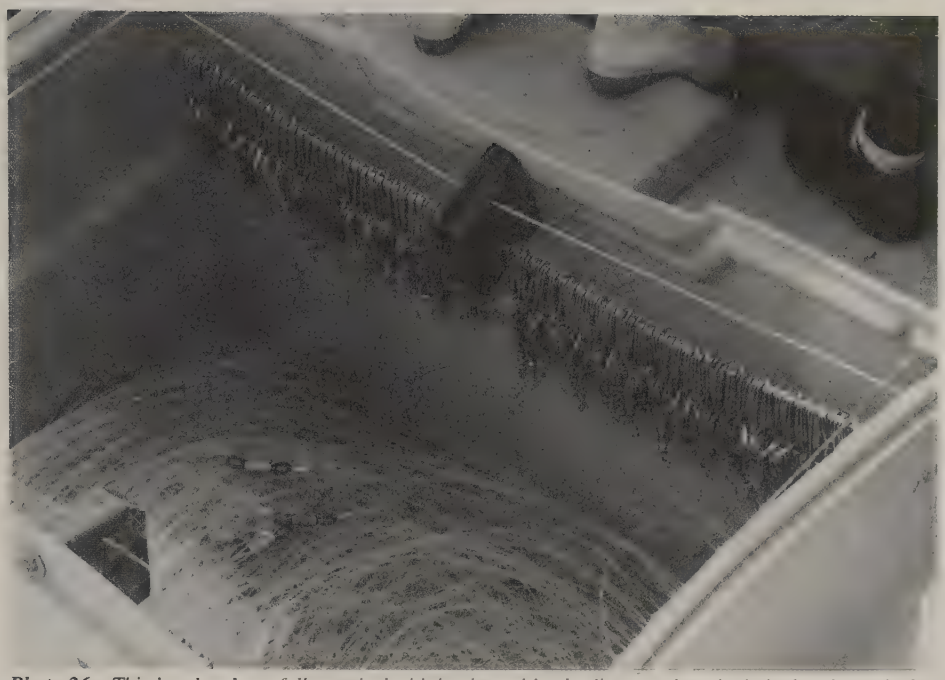

Photo 26.--This box has been fully stocked with hooks and leader lines ready to be baited and attached to the mainline as it is deployed. Dennis Weidner

Seasonality: The peak season for the Barbados longliners is mid-November through mid-May.[107] Swordfish are available off Barbados year round, but abundance is highly seasonal. (See "Species: Seasonality".) Fishermen targeting swordfish report a marked seasonality in yields with the higher yields in the first half of the year and some times at the end of the year beginning in October (appendix B7a-b). This is consistent with the theorized migratory movement of swordfish with many, but not all fish, moving north to rich feeding grounds off New England as the water warms in the spring and summer and then with advancement southward of colder isotherms, retreating southward to the warmer tropical latitudes for spawning.[108] Fishermen targeting tuna and billfish also report seasonal variations in yields, although not as distinct as for swordfish (appendix B7c). As a result longlining fishing effort, like the larger fishery for small pelagics is highly seasonal (appendix B7d).

Grounds: Operations are primarily conducted off the eastern coast, within the Barbados 200-mile EEZ. The authors have succeeded in finding little information on precisely where the Barbados longline fishermen operate. One boat owner indicated that his longliner is capable of fishing as far away as the northeastern coast of Brazil. Most trips, however, are only about 75-150 kilometers. Usually the vessel is deployed east and south out into the Atlantic, sometimes off Suriname and Guyana.[109] Officials confirm that the Barbados longliners do not venture south of 5°N and most fishing is conducted within the 200-mile EEZ.[110]

Target species: Barbados fishermen were initially very interested in swordfish. Some fishermen would make deep sets at night for swordfish and tuna and more shallow sets during the day for billfish. In recent years, because of weak swordfish prices and strong tuna prices in the United States, most fishermen target tunas.[111] The major tuna species targeted are surface species like yellowfin, as well as billfish (mostly marlin). Swordfish is also targeted, although to a lesser extent. Fishing on swordfish declined in 1997 and 1998 (appendix B7e).

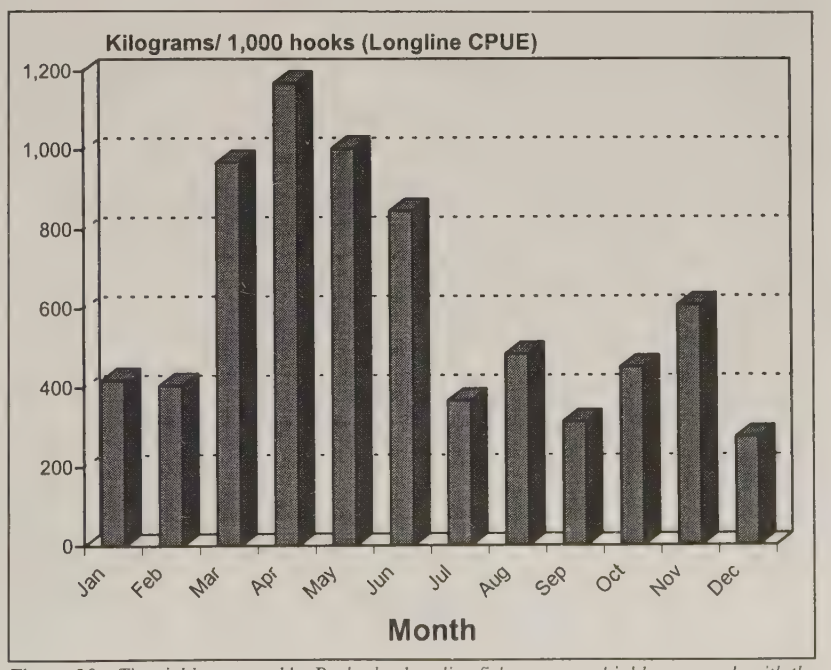

Figure 20.--The yields reported by Barbados longline fishermen are highly seasonal, with the best results from March to June.

Photo 27.--This photo shows the typical arrangement of the aft deck on a Barbados longliner. Notice the reels, ice hold, hook boxes, upper deck gear pound, and radio buoy. Dennis Weidner

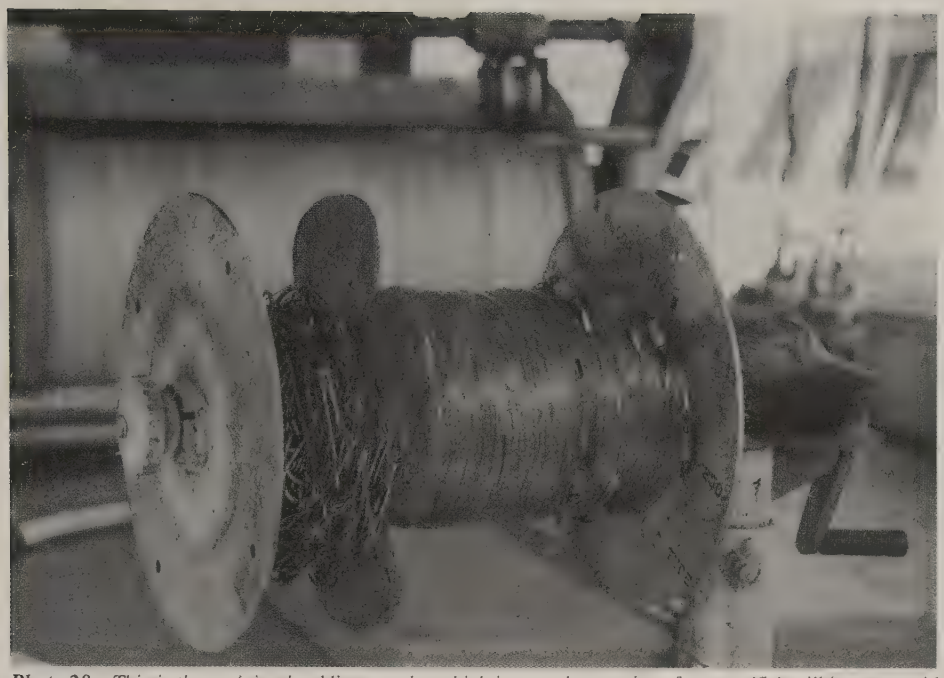

Photo 28.--This is the gangion hookline spooler which in actual operations for swordfish will have a squid baitbox set along side. Dennis Weidner

Line: Barbados fishermen in the early 1990s were deploying relatively short mainlines, about 25-30 km, with 200-250 hooks (appendix B5a). The fishermen have gradually been deploying longer lines with a greater number of hooks. One fisherman described deploying a longline of about 65 km with 400 hooks.[115]

Depths: The depth of the hooks vary significantly depending on whether the target is tuna and billfish or swordfish. Tuna billfish sets generally rig the hooks for depths of about 45-60 meters. Swordfish sets are deeper, 75-120 m (appendix B5a).

Methods: Fishermen have experimented with various fishing strategies. One fishermen reported little difference in overall catch rates, but widely varying species composition in different sets by varying the depth, time of set, and bait.[112]

Crews: Barbados longliners generally have crews of 3-5 persons, varying by vessel sizes. Longliners 12-15 m might have crews of about 5 persons while setting for swordfish, but can be reduced to 4 persons for tuna because of the more shallow depths. Some small longliners might have crews of only 3 persons. Larger longliners exceeding 23 m may have crews if 7 persons or more, but there are relatively few such longliners in the Barbados fleet.[113]

Sets: Captains conduct both day and night sets. Day sets are the most common as the primary target species is tuna. Tuna sets might begin at 3:00 am in the morning. They might be retrieved beginning about 1:00 pm. Swordfish lines are usually set a dusk, about 6:00 pm and retrieved early in the following morning, about 6:00 am (appendix B5a).

Baits: Flyingfish are commonly used for bait when targeting tunas and billfish. Squid is used when targeting swordfish (appendix B5a).

Light sticks: As the fishermen are primarily targeting tuna, light sticks are not used. Fishermen targeting swordfish, however, will use them.

Satellite imagery: Barbados longliners are not equipped to use satellite imagery for locating possible areas to target.[114]

Photo 29.--This is the hauling davit which will be used to retrieve the mainline and bring the catch on board. Dennis Weidner

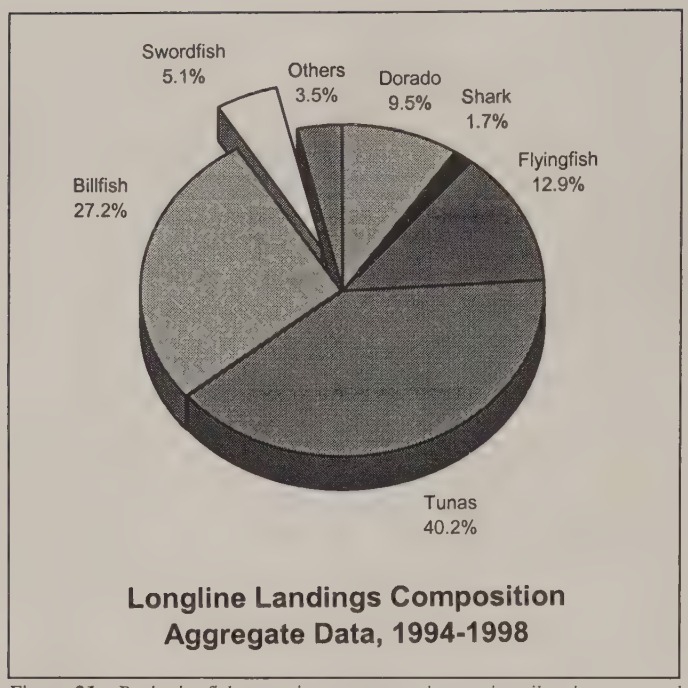

Figure 21.--Barbados fishermen in recent years have primarily taken tuna and billfish. Swordfish has only been a small part of the catch.

Catch composition: The composition of the catch varies widely depending on whether it is a swordfish or tuna set. Swordfish sets can approach annual averages of 50 percent swordfish (appendix B6). Particularly high percentages are noted from December to March (appendix B7b). The overall swordfish production of the fleet, however, is relatively low as so much effort is focused on tunas and hooks are not set at the deeper depths where swordfish are most commonly taken. Only about 5 percent of the longline catch since 1994 has been swordfish (appendix B2). The swordfish catches on a surface tuna/billfish set are usually nil or extremely small numbers (appendix B5a-b B6, and B7c). Some fishermen make surface sets during the day which can yield to more billfish catches, about 45 percent. Deep sets according to one report yielded only about 15 percent billfish.[116]

The swordfish catch of the Barbados longline fleet is relatively limited. Longline fishermen during 1994-98 reported swordfish constituted only about 5 percent of landings. In terms of quantity, it is the least important of the major species of interest to the fishermen (appendix B2). The species the fishermen target are tunas, primarily yellowfin. Tunas constitute over 40 percent of landings and billfish over 25 percent.[117]

Swordfish catches have declined in recent years.[118] The fishermen now rarely report taking swordfish.[119] One recreational fishermen knowledgeable about the longline operations says that they have not taken swordfish in years.[120] Swordfish does not appear to be heavily targeted by the fishermen in recent years.

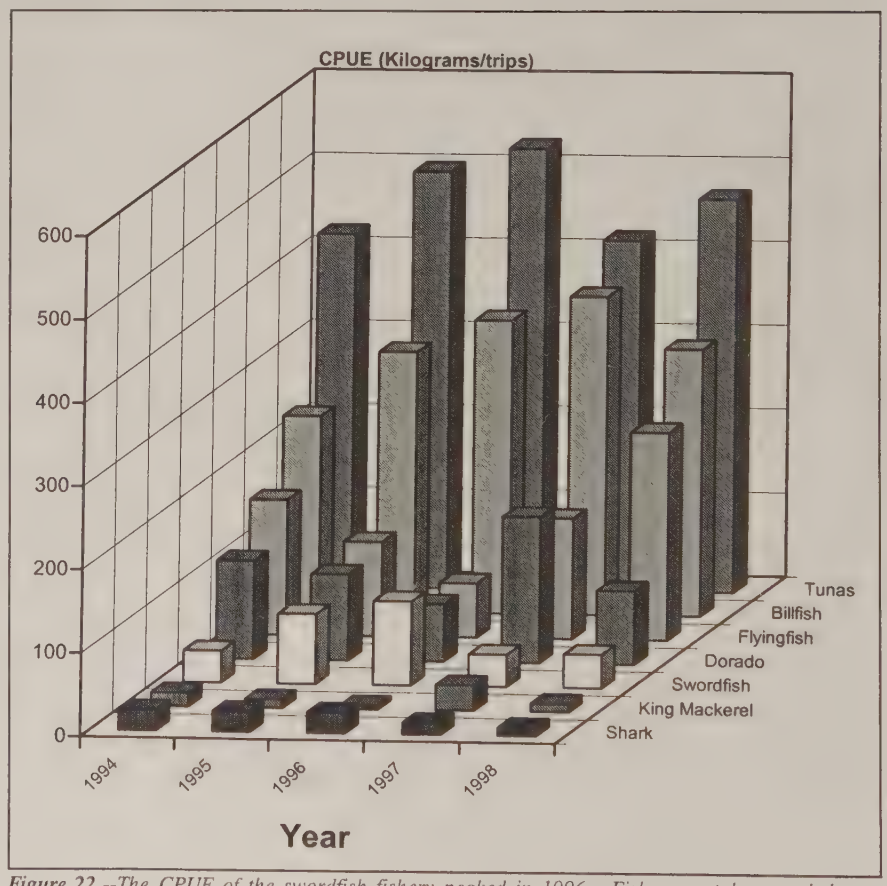

Figure 22.--The CPUE of the swordfish fishery peaked in 1996. Fishermen taken much larger quantities of billfish than swordfish.

***Photo 30**.--The aft deck of this longliner is covered by a platform serving as a gear "compound". Note the mainline and ganglion reel arrangement along with the aft pilot station. Dennis Weidner*

***Photo 31**.--This crew member is helping to clean out the ice in the hold at the end of a fishing trip. Note the reel arrangement to the right. Dennis Weidner*

Photo 32.--Most Barbados longline fishermen have radio buoys. Some only have one or two. This longliner is equipped with four. Dennis Weidner

The owners of two longliners acquired in 1993 or 1994 contracted experienced U.S. fishermen to operate the vessels.[121] Another owner hired an American captain, but found he did not work well with the crew.[122] One of the major problems was that American captains are used to receiving a extra share of the proceeds or "super" bonus. This is not a common practice in Barbados and was resented by crews. The U.S. fishermen doing test fishing off Barbados under contract targeted primarily tuna and billfish. Swordfish catches were only incidental (appendix B3a-b).

One University of West Indies (UWI) researcher indicates that Barbados fishermen have not been able to achieve profitable results with operations targeting swordfish. The necessary gear, light sticks, and baits are expensive imported items and thus significantly increase operating costs. This makes swordfish operations more costly than operations for other species. The fishermen are not convinced that such investments are worthwhile or that they could profitably employ the gear and equipment if purchased. As a result, Barbados fishermen have primarily focused on other species, especially tunas, but also billfish, wahoo, and dorado.[123] Many boat owners who initially longlined are having second thoughts about the fishery. Some have reportedly converted their operations to flyingfish, which unlike the large pelagics, are still relatively plentiful off Barbados. Many of the fishermen are deploying traps for the flyingfish.[124]

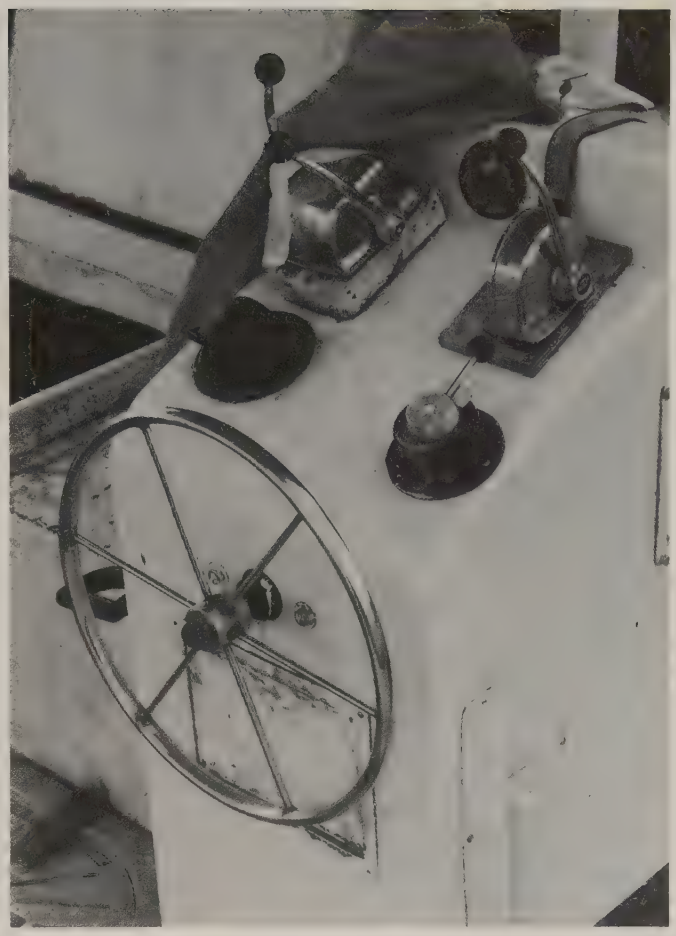

Photo 33.--During fishing operations the boat and mainline are controlled at this station behind the wheelhouse. Dennis Weidner

The catch rates of the Barbados longliners are well below the results reported by American boat captains with advanced technology. The reasons for this disparity is not fully understood, but several factors may be involved. A number of these factors are inter-related.

Vessel management: Many boats are not operated by the owners. The owners vary greatly as to the supervision and managerial oversight afforded the captain and crew. Some local observers believe that many vessel owners do not insist that their crews maximize potential yields. Some crews may return to

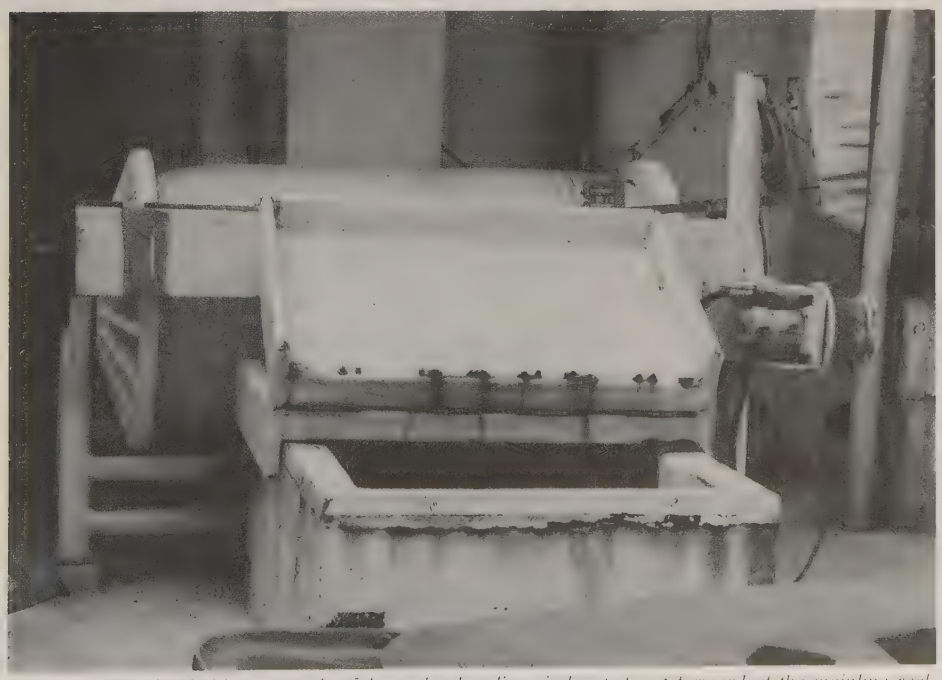

Photo 34.--The ice hold to store the fish on this longliner is located just forward of the mainline reel. Dennis Weidner

port as soon as they have enough fish to net a good pay check. They may not be interested in optimizing yields, but rather in returning to port as soon as possible to enjoy what they have already earned.[125] The lack of owner operators may also affect the ability to acquire and use the latest innovations in gear and methods.

Photo 35.--The "Hi-Flyers" to help locate the line can be seen on these longliners. The tube at the right is for funnelling ice into the hold. Dennis Weidner

Technology: Fishermen generally are self-taught and use domestically developed fishing strategies. Some investors believe that technical innovations widely used by commercial fishermen (such as using satellite imagery, echosounders, light sticks, and other new technologies) are needed to increase catch rates. There appear to be constraints, however, limiting the introduction of modern technology to the Barbados longline fishery. Barbados captains employed to operate the boats, while often gifted intuitive fishermen, are not well educated or the type of individuals who are going to keep abreast of modern innovations in fisheries technology. The Barbados owner faces a dilemma. If he installs satellite imaging equipment, the captain may be tempted to sell the output to other vessels that do not have the equipment. He may also be tempted to seek a better contract because of his improved skills. These and related problems have caused investors to hesitate on making costly investments in new technology.[126] Barbados fishermen, as a result, still use basic technology and fishing strategies.

Methods: Unlike some of the other South American and Caribbean longline fisheries, there has not been a great foreign impact in Barbados. There is relatively little interaction with U.S. and other foreign vessel operators.[127] Some captains have worked on U.S. vessels. In general, the interactions with foreign fishermen have been limited. As a result, one effective avenue of technology transfer has not been available to the Barbados fishery.

Photo 36.--These longline fishermen are landing their tuna catch at the Bridgetown fishing port. Chris Parker

There are some advantages and disadvantages of operating from Barbados as opposed to other Caribbean islands. The two key variables appear to be access to fishing grounds and fuel costs.

Fishing grounds: Barbados is

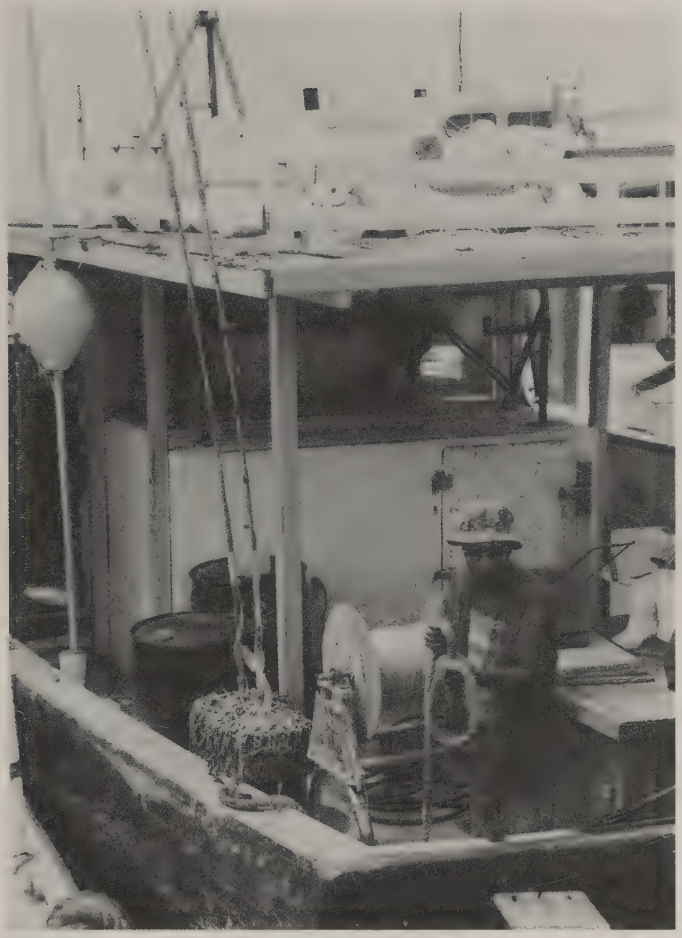

Photo 37.--Many Barbados longline vessel stay in port for extended overhauling and maintenance. Dennis Weidner

well situated in relation to fishing grounds. The island is located to the east of the islands of the southern Lesser Antilles. As a result, it has a large Atlantic EEZ and is located closer to the Atlantic fishing grounds than any other neighboring island. Barbados has the largest longline fleet targeting swordfish of all the Caribbean islands except Cuba. They are located closer to the grounds than countries like Trinidad which also has a small fleet which can target swordfish. Islands to the west like St. Lucia, St. Vincent, and Grenada have smaller Atlantic EEZs and are further from Atlantic grounds. The small longliners deployed by fishermen on these islands are mostly used in coastal fisheries and rarely venture far into the open Atlantic.

Fuel costs: Fuel is very expensive on Barbados. Fuel costs are generally higher on Caribbean islands than is the case in the United States. One of the few exceptions is Trinidad which is an oil exporter. Notably, Trinidad is the only neighboring island whose fishermen can also target swordfish.

The authors know of no recent study assessing actual operating costs for Barbadian longline fishermen. The Bellairs Research Institute in 1993-94 prepared a feasibility study for the Barbados Development Bank. The study included an assessment of operating costs based on the experience of Barbados and foreign fishermen operating in the southeastern Caribbean (appendix A5). One notable observation from the data presented was that swordfish and tuna/billfish trips had almost identical costs--except for larger bait and crew costs for the swordfish trips.[128] The squid used for bait and the need for light sticks raised the bait costs. Crew costs were higher because the deeper sets required larger crews to handle the gear.

Commercial fishermen in Barbados are paid as part of a share of the profits. The proceeds from the trip are split with the owner and then the crew's share is generally split equally. An extra or larger share for the captain is not a commonly accepted principle in Barbados.[129] While certainly egalitarian, this probably affects who is attracted to work as a captain on the Barbadian longliners. While longline crews report good earnings in Barbadian terms, the captain's earnings are well below what a U.S. captain might expect. Thus really talented individuals may look elsewhere for more lucrative prospects. This may be a factor in the results reported by the Barbadian fleet.

C. Recreational

Tourism is one of Barbados' principal economic sectors and recreation fishing is one of the island's many tourist attractions. Barbados recreational fishermen, however, have been generally disappointed at the support they have received from the Barbados Tourist Board. Recreational fishermen complain that their sector is not promoted extensively by the Tourist Board. One sport fisherman complains, "Tourist Board people don't fish."[130]

Photo 38.--This sailfish was landed at Bridgetown by Action/Cannon Charters. Stephen Roach

The small Barbados recreational fishery initially targeted mostly billfish (marlins and sailfish). Charter boat operators now target a wider range of species, including yellowfin tuna, wahoo, dorado, and other species.[131] Most operators report that swordfish never strike or have not experienced a swordfish strike in years.[132]

There are a large number of privately owned recreational boats. Barbados recreational fishing is generally conducted by small operators with one or two vessels. Some of the larger operations are Blue Marlin Charter and Cannon Charters. Most of the charter boats are individually owned by boat captain.[133] Barbados sources provide varying estimates on the number of recreational fishing boats, from 20-35. Officials report 12 established charter boats in Bridgetown.[134] Industry sources estimate that as many as 15-20 boats may be active most of the year. The others are maintained by recreational fishermen who may occasionally contract charters for tournaments.[135] The charter boats focus on wahoo, king mackerel, and dorado on inshore trips. Big game fishing for marlin, sailfish, and tunas is also available.[136] The Barbados Game Fish Association (BGFA) has maintained records on recreational fishing since 1978. The peak season for the Barbados recreational fishery is mid-November through the end of April when the last tournament is held.[137]

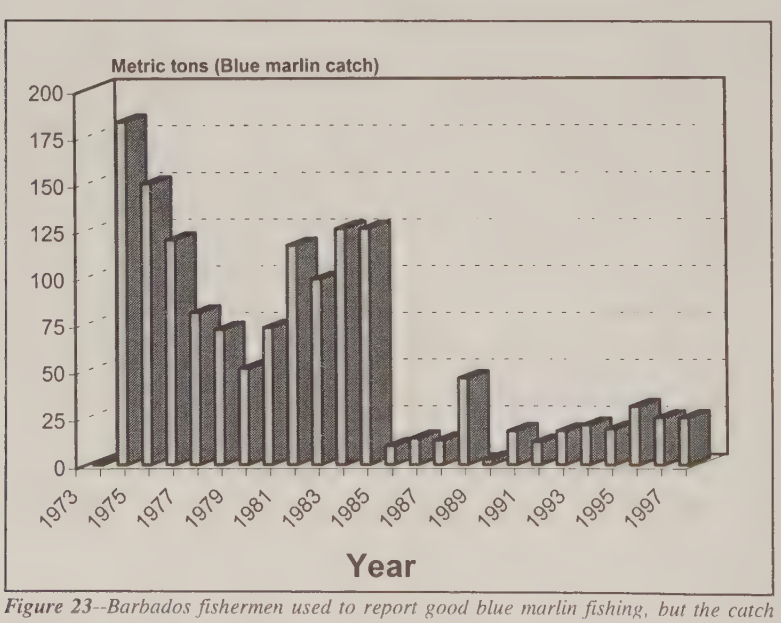

Figure 23--Barbados fishermen used to report good blue marlin fishing, but the catch dropped precipitously in 1985.

The sport fishery is promoted by the Barbados Game Fishing Association (BGFA) which was formed in June 1961. The BGFA has approximately 20 local sponsors, of which the largest are Mutual Insurance and Mount Gay Rum. Since 1961 BGFA has continually run tournaments, primarily from November through April. The BGFA is responsible for organizing a large number of competitions. The inshore tournaments (15-18 ft open boats) begin in July and end in November, and are usually held from 5 p.m. to midnight. The targeted fish are barracuda, snapper, crevalle and goggle-eye (big-eye). In November and January two 1-day wahoo tournaments are held. From February to early April, five 1-day national deep sea events are held. The fish targeted are wahoo, dorado, marlin, sailfish and yellowfin tuna. These national tournaments usually involve 35-45 people on 10-15 boats.[138] The island's major

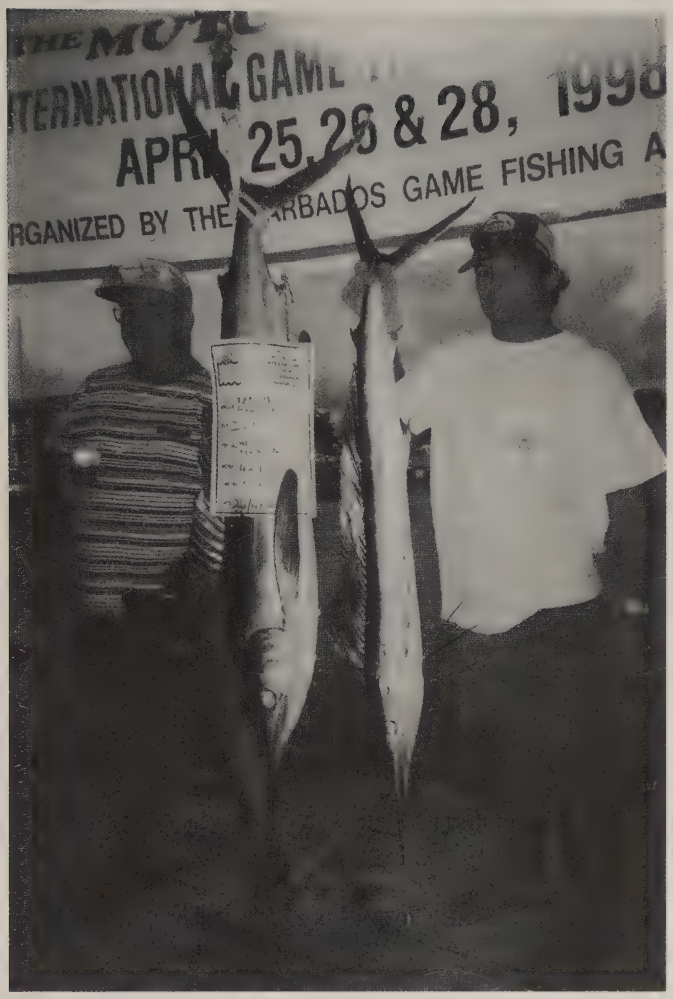

Photo 39.--These white marlin were taken at 1998 tournament organized by the Barbados Game Fishing Association. Mark Farber

tournament is the Mutual/Mount Gay International Tournament which was held in the third and fourth week of April each year and is scheduled for April 21-24, 2001. The fish targeted are the same as for the 1-day deep sea events. There are usually 130-140 participants from many different countries in 25-30 boats in this event.[139] Only about 115 participated in 1999 because of rough seas--a serious concern with small recreational boats. This is the most extensive series of tournaments held in the Caribbean.[140]

Billfish tournaments in 1992 initiated tag and release activities.[141] Data on billfish catches is collected submitted to ICCAT. Data is available on size frequency as well as catch and effort data from the various tournaments. Tag and release fishing initially proved to be a hard sell for BGFA as boat operators derived income from selling their catch. Offering good prizes for tag and release fishing helped to popularize it.[142] Many tournaments offer prizes for the most fish released.[143] Tag and release activities are now becoming increasingly common at the tournaments.[144] Small fish are usually released, although this varies by boat. (See below.) Larger fish are often taken to one of the public markets and sold at the current day's price.[145] The proceeds are distributed between the BGFA and the crew.[146] The BGFA uses the proceeds to defray the expenses of the tournament.

Barbados sport fishermen doing tag and release fishing follow the International Game Fish Association (IGFA) guidelines. All juvenile fish are normally released, including blue marlins (under 150 lb), white marlins (under 40 lb), tuna (under 40 lb), sailfish (under 40 lb), wahoo (under 20 lb), and dorado or dolphinfish (under 20 lb). Actual practices, however, varies from boat to boat. Some skippers retain all marlins over 100 pounds.[147]

Barbados' recreational fishermen use the latest in gear and electronic equipment. Both nylon and wire lines are used depending on the targeted species. Wire line, however, is not allowed in the international tournaments in accordance with IGFA rules. The most common test lines used are 20, 30, 50, and 80 lb.[148] The bait used are flying fish, ballyhoo and artificial lures. Most anglers prefer fresh or live bait rather than frozen bait or lures, but this varies by boat.[149] Most charter boat captains try to use fresh rather than frozen baits as much as possible. Fishermen generally buy their artificial lures from the Fisherman's Corner near the pier from which the Bridgetown charter boats operate. The crew is normally two to three persons.[150] Some charter boat operators participate in tournaments in Barbados as well as other Caribbean islands like nearby St. Lucia or the more distant Martinique.[151]

The fee schedule varies considerably. Anglers can participate in deepwater fishing for as little as $10 per person a day. The fee to participate in sanctioned international tournaments is usually about $100.[152]

The sport fishermen are concerned about declining catch rates reported during the 1990s. The BGFA reports recreational catches began to decline notably in 1993.[153] Other observers report that fishing has been poor since 1996.[154] One fisherman reported that 1999 was shaping up as poorest season in his memory. In one tournament only two marlin and one sailfish were boated in the entire competition.[155] Fishermen report that only one sailfish and no marlins were caught in the big 1999 International Barbados Mutual Game Fishing Tournament.[156] The BGFA has not noted a decline in the size of the fish, but has definitely noted a reduced abundance.[157]

VII. Catch

The Barbadian fisheries catch is dominated by the fishery for flyingfish. Artisanal fishermen landed 1,600 t of flyingfish or nearly 60 percent of the overall 2,800 t taken in 1997 (appendix C1b). A variety of different species of flyingfish are taken, but the primary species is *Hirundicthys affinis*. The only other species taken in significant quantity is dorado. Small catches of tuna and billfish are reported.

Commercial longliners landed most of the Barbados large pelagic catch which is primarily composed of tuna. Substantial billfish catches are also reported, in many years actually exceeding the tuna catch. Swordfish catches appear to be extremely limited. The authors have noted some variance among different sources on the island's fishery catches (appendix C3a1).[158]

1970s: ICCAT reported substantial blue marlin catches in some years. The record catch of 183 t was reported in 1974 (appendix C4). The authors are unsure as to what fishery was involved.

1980-84: Substantial blue marlin catches were reported ranging from 73 t in 1980 to 126 t in 1983-84 (appendix C4).

1985-87: Barbadian fishermen, according to FAO, landed 70-90 t of yellowfin and skipjack tunas as well as more than 100 t of billfish annually (appendix C1b). ICCAT data, however, does not confirm these large billfish catches (appendix C4). The authors have little information on the nature of this fishery during the 1980s. The country in the mid-1980s was only beginning to acquire longliners. This is far beyond what could be taken by the country's recreational fleet. Artisanal fishermen may have taken some fish as well as the expanding ice boat fleet. It is unusual, however, for a country to catch more billfish than tuna. Through 1987, no swordfish shipments were reported to the United States, suggesting that domestic catches were minimal.[159] No actual data on domestic swordfish catches, however, is available to the authors. Barbados' new longline fishermen reported disappointing catches in 1987 and blamed El Niño.[160]

1988: One longliner, the *Dragon Bay*, was reportedly active in 1988.[161] FAO data shows that Barbados reported an unusually high overall fisheries catch in 1988 with notable catches of flyingfish and dorado. There was also a record tuna catch reported, especially an usually large skipjack catch (235 t). Billfish fishes catches were also at record levels (333 t) (appendix B1a). ICCAT data confirms unusually large tuna and billfish catches (appendix B2). There appears to have been a notable catch of white marlin (appendix C4). Some of this substantial catch may have been the result of test fishing chartered or allowed to transship by the Barbados Government. Tuna, swordfish, and related species were landed by two U.S. longliners (*Kristin Lee* and *Janice Ann*) which the Barbados Government in February 1998 allowed to use Bridgetown as an operational base on condition that the fishermen submit detailed catch and effort data to the FD. Fishing was conducted from September 1988 to January 1989 (appendices B3a-b). Both U.S. longliners were modern 15-m longliners deploying 50-km mainlines with 300-360 hooks. They caught nearly 20 t of swordfish. They operated south of Barbados and around St. Vincent to the west of Barbados.[162] No information is available on what else caused the significant catch increase in 1988. U.S. import data indicates that swordfish was shipped from Barbados in 1988. The quantity involved when compared to U.S. imports, indicates that some of that catch was marketed on Barbados (appendix B3a2). This suggests that the domestic swordfish catch was minimal.

1989: The Barbados fisheries catch dropped precipitously in 1989. The flyingfish catch of 1,400 t

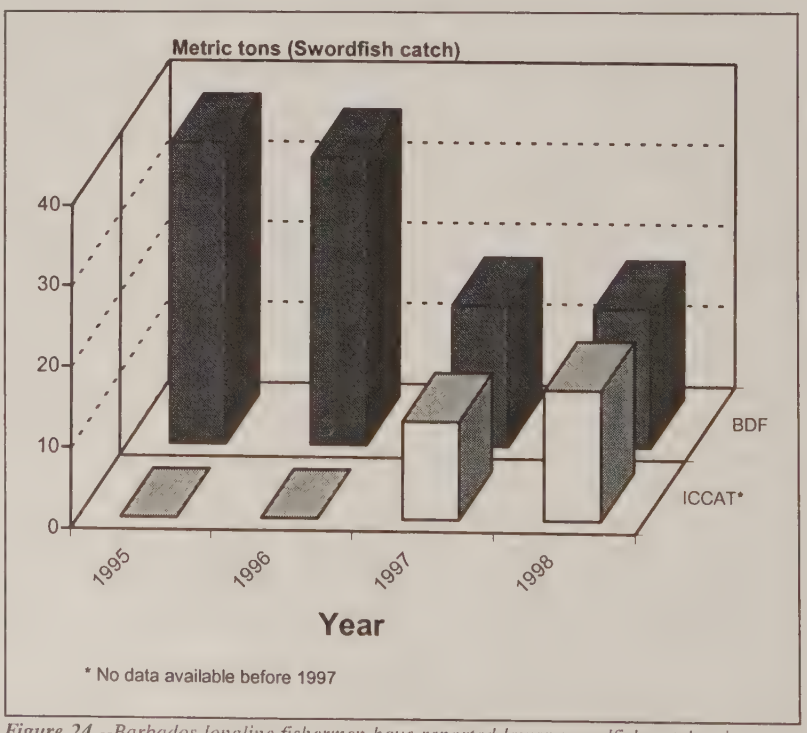

Figure 24.--Barbados longline fishermen have reported lower swordfish catches in recent years and are mostly targeting tuna and billfish.

was less than 25 percent of the 1988 catch--although 1998 was an unusually good year (appendix B1a). The disappointing 1989 coastal pelagic catch, which the artisanal fishermen rely upon, prompted FAO to sponsor an assessment of available catch data from St. Vincent and neighboring islands.[163] Barbados fishermen reported very small catches of oceanic pelagics. Fishermen according to FAO took only 86 t of tuna and a slightly larger billfish catch in 1989 (appendix B1a). The two U.S. longliners allowed to operate out of Bridgetown landed 12 t of swordfish in fishing during December 1998 and January 1989.[164] U.S. imports show limited shipments, except in 1989. U.S. imports in that year suggest a Barbadian catch of about 40 t (appendix B3a2). Such an unusually large shipment in 1 year suggest that the fish may have been supplied by a foreign longliner or a temporary joint venture with a foreign company. No specific details, however, are available. It is probably fish associated with test fishing projects contracted by the Government.

1990-91: FAO data shows that Barbados fishermen reported an improved tuna catch of 86 t in 1990 (appendix B1a). Fishermen took more billfish than tuna in 1990, although the quantities were comparable (appendix B1a). The 1990 billfish catch exceeded 100 tons. ICCAT reported comparable 1990-91 results (appendix B2). ICCAT data shows a notable billfish catch with sailfish the species of greatest importance. No Barbadian data is available to the authors on swordfish, but the catch is believed to have been limited as there were minimal shipments to the United States in 1990 and no shipments in 1991 (appendix B3a2).[165]

1992: Fishermen according to FAO increased the tuna catch to 115 t in 1992 (appendix B1a). The billfish catch totaled nearly 85 t, a catch estimate confirmed by ICCAT (appendix B2). Minor quantities of swordfish were shipped to the United States, suggesting about 7 t of Barbados-caught swordfish was exported to the United States (appendix B3a). The Barbados Development Bank reported several requests for buying longliners.[166]

1993: FAO reports only a small decline in the tuna catch to about 105 t during 1993 (appendix B1a). ICCAT data suggests a substantial catch increase of tuna and other oceanic pelagics during 1993, perhaps reflecting the increasing capacity of the new longliners being added to the fleet. The tuna catch reported by ICCAT in 1993 totaled nearly 170 t as well as over 90 t of billfish. Much of the billfish appears to be white marlin and sailfish (appendix C4). Very small quantities of swordfish were shipped to the United States suggesting that Barbados shipped about 2 t of domestically fish to the United states in 1993 (appendix C3a2). Actual catches were probably slightly larger as some fish is consumed domestically, mostly in the tourist trade. U.S. imports are potentially a good indicator of domestic trends as there are no known exports to countries other than the United States (appendix E1).

1994: Data provided by the DF beginning in 1994 provides a clearer picture of swordfish catches. The steady acquisition of longliners by the local fishermen provides the island and expanding capability to target tunas, swordfish, and other oceanic pelagics (appendix A2a2). The 1995 catch was about 18 t (appendix B3a1).[167]

1995: Barbados fishermen reported their record swordfish catch of 37 t in 1995, almost double the 1994 catch (appendix B3a1). The increasing catch was due the expanding fleet as well as the domestic fishermen's increasing proficiency with longlining.

1996: The 1996 swordfish catch total 36 t, about the same as in 1995 (appendix B3a1). Fishermen by 1996 had acquired most of the country's longline vessels, although a few more were acquired in 1997 and 1999 (appendix A2a2). Despite the expansion of the fleet, the overall oceanic pelagic fisheries catch, including the tuna catch, declined by nearly half (appendix B2b).

1997: Barbados officials indicate an increase in the overall catch of large pelagics, but this may have been due to more accurate reporting and sampling procedures in 1997.[168] Barbados officials report a domestic swordfish catch of about 17 t (appendix C3a1). U.S. fishermen transhipped about 100 t of swordfish through Barbados, about six times the domestic catch (appendix C3a2). The swordfish catch followed the overall trend and was also down by about half to only 17 t (appendix B3a1).

1998: Barbados fishermen reported a swordfish catch about the same as in 1997--17 t (appendix B3a1). Some local sources believe that poor catches of swordfish and other species are related to changing current patterns.[169] The 1997 and 1998 swordfish catches may also reflect fishing patterns with the fishermen focusing mostly on tunas as a result of strong markets for tuna and a weak swordfish markets in the United States. U.S. fishermen also reduced transshipments through Barbados, reporting only 22 t in 1998 (appendix C3c1).

1999: Barbados sport fishermen during 1999 reported extremely poor billfish catches.[170] Swordfish catches for the first half of the year were down nearly 10 percent from 1998 levels (appendix B7e).

VIII. Ports

The two major ports used by Barbadian fishermen are Bridgetown and Oistins, both of which are located along the southwestern part of the island and have important fishery complexes. Fish is landed at over 30 landing sites all around the coast, but mostly on the western side. The FD classified these sites as primary (markets), secondary (sheds), and tertiary (beaches) depending on the physical infrastructure. The only primary ports are Bridgetown, Oistins, and Speightstown. There are about 11 secondary sites on the island of any consequence, the largest of these secondary locations are Conset Bay and Skeete's Bay. Secondary sites may have sheds and slabs for cutting fish. Most of these secondary and the tertiary sites have few facilities for the fishermen.[171]

Bridgetown and Oistins usually account for about 80 percent of Barbados' overall fisheries catch and all of the catch landed by the new longline fishery. Fish tolls, statistics (catch, effort, and price data) are collected at the fish markets, all managed by the Markets Division.

A. Bridgetown

Port facilities are available in three areas of Bridgetown.

1. Main cargo port

Bridgetown is one of the most important ports in the Caribbean. The Port of Bridgetown is a general services port, managed and operated by the Barbados Port Authority as a commercial enterprise geared to market forces through competitive pricing and efficient services. Fishing activity is a small part of the port's operations. The nautical approach to Bridgetown is clear, with deep water over 10 meters. The Port has a skilled labor force, trained to international standards. Labor relations are harmonious with the labor force working as partners with Port management. Partly due to this relationship, the Port of Bridgetown was awarded the "Port of The Year Award" in 1992, 1994, 1996, and 1997, citing it as the most efficiently run port in the Caribbean. The port in 1997 handled over 680,000 t of containerized cargo and even more bulk goods. Fishery products were not a major part of the shipments. The main channel depths 9.6 meters. The main terminal is port-owned; Operator: Barbados Port Authority; Containers & breakbulk cargo; 8 Berths; Length: 1,498 meters; Depth: 9.75 meters. Berthing lengths go up to 244 m; W/Bow Thrusters: 243 m. the maximum draught is 9.6 meters. The protective breakwater is built of solid concrete; more than 805 m; comprises an outer and inner arm; Width: 9.3 m; Outer Arm: 522 m; Inner Arm: 307 meters. The cold storage capacity: 2,100 tons frozen (18°C), 300 t chilled (+2°C); 4 Tower units for holding of conair containers and electrical points for the holding of integral containers. Other port area services include: bunkers/fuel; chandlery; cold storage; freshwater; electricity; environmental/waste; warehousing/bonded; towing and tug services; gantry & mobile crane; duty-free shops; customs, immigration and health offices; tourism authority office; banking facilities; and a security office.[172]

Photo 40.--James Bardon is part of the efficient management team which runs the Barbados fishing port. Dennis Weidner

Photo 41.--A full range of port services are available to the fishermen at the Bridgetown fishing port. Dennis Weidner

Photo 42.--This fishermen is filling his ice hold. The Bridgetown fishing port provides services to both artisanal and commercial fishermen. Dennis Weidner

Photo 43.--An extensive breakwater at the Bridgetown fishing port has been constructed by these concrete rip-rap, providing a secure harbor from all but the most violent hurricanes. Dennis Weidner

country's fisheries infrastructure.[177]

The Bridgetown fishing port is the bustling hub of Barbados' fishing industry. Crowding at the port is a serious problem. The now extensive longline fleet shares the port with other commercial and artisanal fishing vessels. The crowding at the port is due in part due to the fee structure.[178] Vessel owners have little motivation to move inactive boats out of the port. As a result, several idled boats are moored there for extended periods. One large boat, for example, the *Neptune Goddess*, is rarely deployed and for an extended period of 1999-2000 has taken up a large area of dock space by the seawall.

2. Commercial fishing port

The Bridgetown fishing port is a separate facility located south of the main port, closer to downtown Bridgetown. Over half of the country's fisheries catch is normally landed at Bridgetown. The Barbados Government initiated a feasibility study for a modern new port in 1980.[173] The Inter-American Development Bank (IDB) approved an $8 million port modernization project in 1984.[174] The new fisheries terminal at the port incorporates landing, chill, cold storage, and freezing facilities. New breakwaters were also added to the harbor.[175] The extension of the breakwater with concrete rif-raf provides a safe harbor for the fishing fleet. The port project was part of a larger Government fisheries development project.[176]

The Bridgetown Fishing Port project was reportedly completed in June 1988 at a cost of $10 million and proved to be a major improvement to the

Photo 44.--Longliners tie up in front of the receiving facility. Swordfish and tuna are shipped on to the airport while other species are processed and sold in the adjacent market. Dennis Weidner

Photo 45.--These grey or blue insulated boxes containing ice and fish are a common sight at fishing ports throughout the Caribbean. Dennis Weidner

3. The Careenage

The Careenage is the picturesque old harbor of Bridgetown. A small river run out to the sea through Bridgetown. The resulting inlet, the Careenage, has become the center of the bustling city of Bridgetown. Much of the Barbados sport fishery is conducted from the Careenage in downtown Bridgetown.[179] The Barbados Coast Guard's principal base is located there. Occasionally a larger vessel will tie up there. The longliner *King of Kings* was tied up there in 1999 with a prominent "for sale" sign.

The Bridgetown Fishing Port is located only about 15 km from the Bridgetown airport near Oistins. It is, however, located near the center of Bridgetown and trucks carrying fresh swordfish and tuna to the air port must move through heavy traffic in downtown Bridgetown. Often heavy traffic can create a trip of an hour or more. The longline fishermen have the option of landing their catch at the less utilized port at Oistins which is very close to the airport.

B. Oistins

Oistins is the second most important fishing port in Barbados. About 30 percent of the Barbados catch is now landed at Oistins. Oistins is located along the southern coast, about 8 km southeast of Bridgetown. It is particularly convenient for exporters because the Bridgetown airport is only about 5 km or a 10-minute drive from Oistins and traffic is much lighter than in Bridgetown. A small market already existed at Oistins before the new port was built. An EU development project was awarded in 1981 to build a modern port at Oistins Town.[180] Oistins was the first modern, purpose-built fishing port in Barbados. The EU provided $1 million for the port which was opened in 1983.[181] The port has a 140-m jetty making it easy to unload the catch and taken on fuel and supplies. Unlike the Bridgetown fishing port, however, there is no protected breakwater and the port is much less heavily used than the Bridgetown

Photo 46.--Oistins is the second most important fishing port in Barbados. The pier and port facilities were built with assistance from the European Union. Dennis Weidner

Photo 47.--Many artisanal fishermen land their catch at sites with virtually no facilities. Ocean conditions are particularly rough along the eastern coast. Mark Farber

Fishing Port. Until the port was opened, the ice boats had to use the laborious process of hiring tender vessels.[182] Facilities include an ice plant with a 13 t daily capacity, a chill room, retail booths, a haul-out slipway, a service area for boat repairs, and a car park.[183] Some sport fishing is also conducted from Oistins.[184]

C. Speightstown

The Barbados Government in 1982 was planning a fisheries complex along the northern coast at Speightstown.[185] The EDF in 1985 was reportedly studying possible funding.[186] That project was not approved, but the Kuwait Fund for Arab Economic Development in 1995 was reportedly considering a project to modernize the port. Artisanal fishermen are active at the port.

D. Other ports

Artisanal fishermen are also active at Ferguson Yard, Read's Bay, Six Men's Bay, and Half Moon Fort and about 25 other sites, primarily along the western coast. Most of the sites are simply beaches where the fishermen pull their small boats ashore and land the catch with no or only minimal facilities. None of these sites are used by the longliners. The EU in 1996 was reportedly planning a new project to improve two ports (Skeete's and Conset Bay) along the island's eastern coast. Construction was underway in 1999.

Photo 48.--Conset Bay was a isolated east coast landing site with virtually no facilities. The EU in 1999 financed the construction of a cement pier and other port facilities. Dennis Weidner

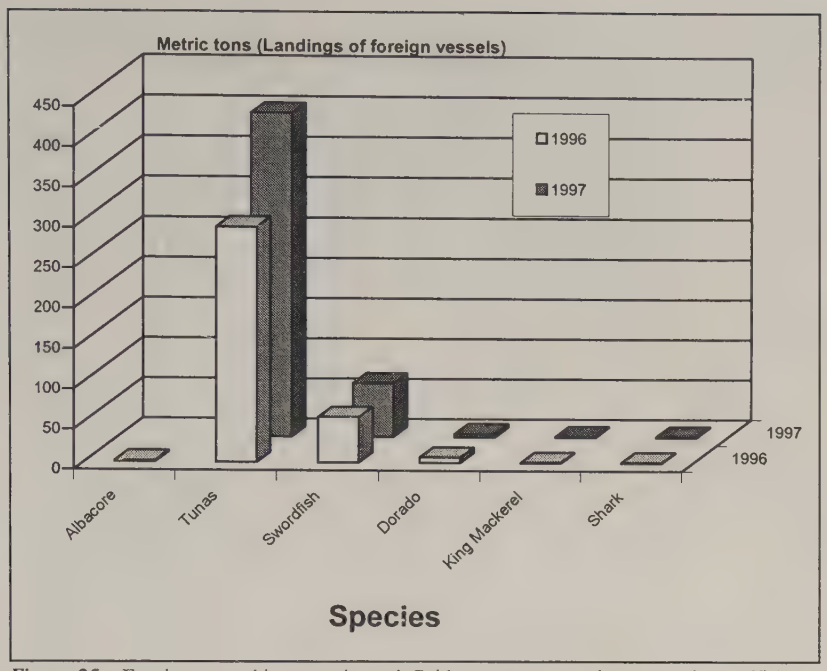

Figure 25.--Foreign transshipments through Bridgetown are mostly tuna and swordfish.

U.S. fishermen land small quantities of swordfish through Barbados. Most of the tuna catch in the Caribbean is transshipped through Puerto Rico. Overall U.S. landings of swordfish caught in the Wider-Caribbean have varied, but U.S. fishermen report that they have exceeded 1,000 t--mostly through Puerto Rico (Caribbean Overview, appendix E1). Shipments through Barbados have been only a small part of that total, reaching a high point in 1997 of 76 t, but have usually been much less (appendix C3c).

U.S. transshipments through Barbados were first reported in 1988-89 when about 40 t were transhipped each year. Subsequent transshipments were non-existent (1990-91 and 1994) or minor (1992-94). U.S. transshipments began to increase in 1995. Since 1995, transshipments have varied from 17-76 tons (appendix C3c1).

IX. Transshipments

Barbados is not a major Caribbean transshipment point. Foreign fishermen do not normally transship through Barbados.[187] U.S. longline fishermen occasional transship at the Bridgetown fishing port (appendices C3c1-2). Barbadian authorities report that no other countries are transhipping swordfish through Barbados.[188] Officials note that Trinidadian longliners occasionally call at Bridgetown, but do not transship their catch there.[189] While U.S. fishermen do transship through Bridgetown, such shipments have been irregular and generally involved only limited quantities of product, primarily tuna with smaller quantities of tuna (appendix C3c2).

U.S. fishermen initiated longline fisheries in the Caribbean and western central Atlantic during the mid-1980s.[190] The U.S. fishermen have since occasionally landed at least some of their swordfish catch in Barbados, mostly for shipment to the United States. U.S. longliners operating in the wider Caribbean generally prefer to land their catch in San Juan, Puerto Rico, but depending on where they are operating, may transship through Bridgetown, Barbados or Port-of-Spain, Trinidad.[191]

The data reported by U.S. fishermen is confirmed by both Barbados data and U.S. import data. **Barbados data**: Data compiled by the Fisheries Department (FD) show roughly the same quantities as reported by U.S. fishermen (appendices C3c1-2). The FD data, however is available for only 2 years. Barbadian officials report that they are collecting more

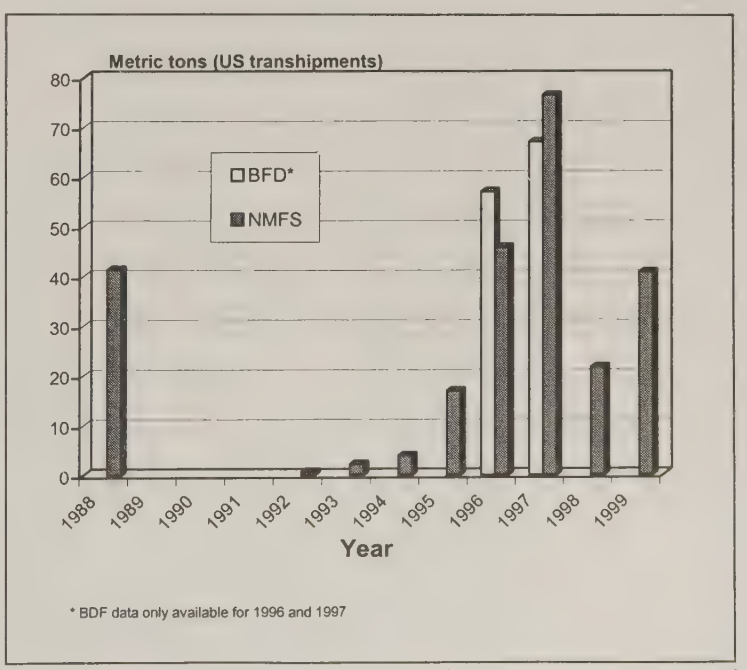

Figure 26.--Foreign transshipments through Bridgetown are mostly tuna and swordfish.

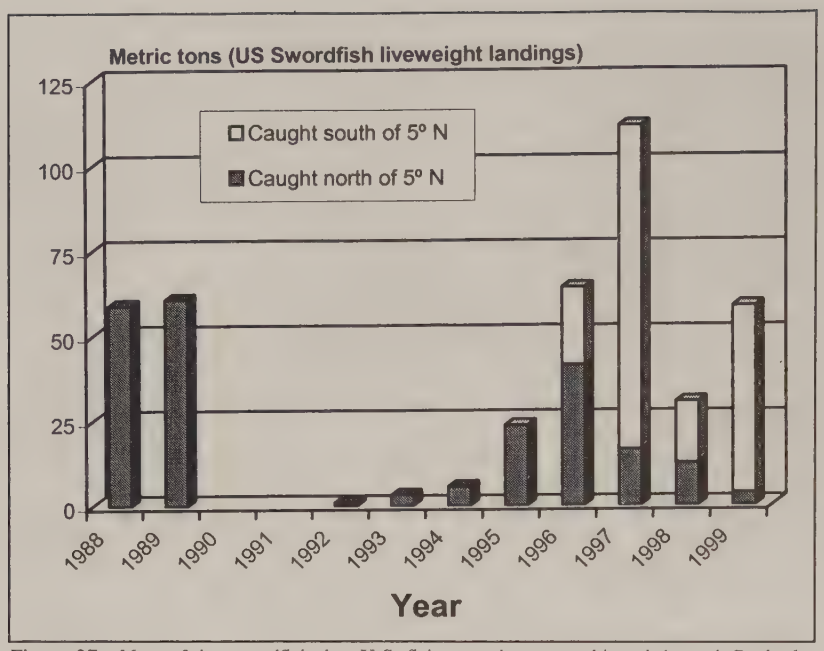

Figure 27.--Most of the swordfish that U.S. fishermen have transhipped through Barbados since 1995 has been caught south of 5°N.

detailed information on swordfish catches and transshipments as part of an effort to compile precise statistics.[192]

U.S. import data: U.S. transshipments through Barbados appear to correlate somewhat with U.S. imports from Barbados for most years (appendix C3a2). A major discrepancy, however, was reported in 1995. U.S. transshipments should not be reported in the U.S. import data. As no tariff is involved, it is not uncommon for such shipments to commonly appear.

COE data: Beginning in June 1999, swordfish exporters shipping to the United States have had to submit a Certificate of Eligibility (COE). NMFS with the COE data can determine the country that shipped the swordfish, regardless of what port it was shipped through. The program is new and there are still compliance problems associated with a new program. The available COE data shows that no swordfish was shipped through Barbados from June-December 1999 and only 1 t from January-May 2000 (Caribbean Overview, appendix F2e1a).

U.S. fishing south of Florida was through 1995 conducted in the Wider-Caribbean. Thus the fish transhipped was taken in the Caribbean or the Atlantic north and east of Puerto Rico, all north of 5°N. U.S. fishermen have since moved into the south Atlantic and since 1997, most of the fish transhipped through Barbados has been fish taken south of 5°N. Almost all of the 41 t (dressed weight) of swordfish transhipped through Barbados in 1999 was taken south of 5°N.

Photo 49.--Fresh fish can be prepared to order at the several Barbados seafood markets. Hygiene standards, however, are often lacking. Mark Farber

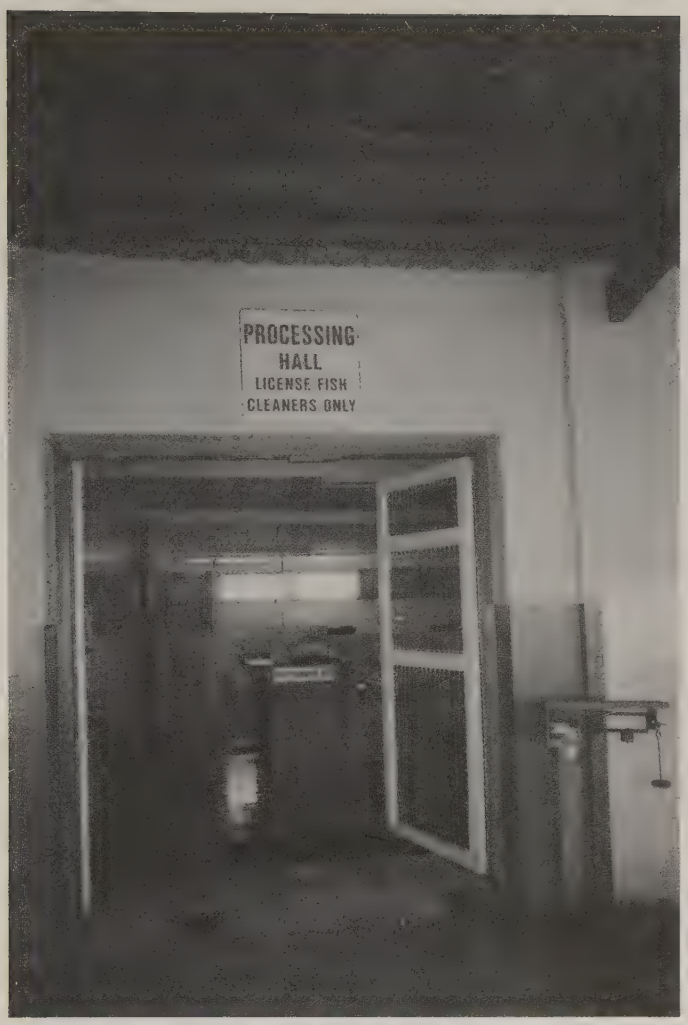

Photo 50.--Artisanal fishermen on Barbados have several modern facilities where they can land and clean their fish. This one is located at Speightstown. Mark Farber

X. Processing and Products

Barbados currently has only a small seafood processing industry. There are seven fish processors in Barbados employing about 125 persons, about four of which also export.[193] Some Barbados companies were involved in extensive shrimp packing during the 1960s and 1970s, but these facilities were closed when fishermen lost access to their distant-water grounds. Most of the country's catch is landed fresh and sold as whole fresh product in local markets. Some processing may take place at beach sites and market stalls. Some of the flyingfish catch is filleted. There is currently, however, little value-added processing. Barbados is one of the more advanced Caribbean island countries. The large tourist industry on the island has created a demand for high quality fishery products at prices which permit some sophisticated handling. Even so, assessments of fishery products rate the quality of locally produced fish as "just acceptable to very bad". A major problem is that fish is often frozen too slowly in cold stores designed for storing fish, not freezing it.[194]

The commercial fishery for oceanic pelagics is relatively new. The authors know of no large scale processing of tuna, billfish, or swordfish.
Domestic sales: Some fish is frozen for sale in local supermarkets.
Export sales: Much of the catch of acceptable quality is exported to the United States as fresh product. The headed and gutted trunks are simply packed in plastic lined and place waterproof cardboard boxes, and then delivered to the air port. While almost swordfish is shipped fresh to the United States there are occasionally small frozen shipments (appendix E2a1). In addition there were small quantities of swordfish steaks shipped in 1999, about 0.6 tons. Thus a local company is processing small quantities of swordfish.

XI. Companies

A. Trade associations

The Barbados Game Fishing Association (BGFA) is responsible for organizing all fishing tournaments in Barbados. The BGFA was founded in 1961, and is responsible for organizing all tournaments in the island. These include spin fishing, inshore and deep sea fishing.

B. Companies

Barbados seafood companies (such as Barbados Seafood Limited and the Barbados Marketing Company, a state company) during the 1960-70s targeted shrimp off Brazil and the Guianas which it processed shrimp for export.[195] Another company (International Seafoods, another state company) also operated distant-water shrimp trawlers, but these companies closed when Barbados lost access to distant-water grounds during the late 1970s.[196]

Current important companies include:
Barbados Fisheries: One observer reported that Barbados longliners sell most of their catch to Barbados

Fisheries. It is a state-owned company which both sells domestically as well as imports and exports fish. They also provide a variety of services to the local industry, such as selling gear, equipment and bait. Some of the bait, especially the squid is imported.[197] The authors believe that the observer was referring to Fish of Barbados.

Fins & Fathoms: This is the first Barbados company to initiate large-scale commercial longline operations. The company in 1993 was reportedly the only Caribbean company, other than Cuba, that operated longliners over 20 m. Barbados currently has the only 23-m longliner. The company's owners realized during the early 1990s that the only way to expand fishing operations was to shift away from production solely of heavily fished species (flyingfish, dorado, and others) for the domestic market and enter fisheries for oceanic pelagics not targeted by the artisanal fishermen. Such species had the advantage of commanding high prices in major export markets. One of the owners, Jonathan Morgan, indicated, "Both of us felt that, if the Japanese could successfully longline tuna out of St. Maarten and the Taiwanese can do it out of Trinidad, then a Barbados-owned and operated company could be successful." The company, using a U.S. broker, acquired two vessels in 1992 (the 27 m *Colleen Cheramie* and the 24 m *King of Kings*) and had them refitted for longline operations (appendix A2b). U.S. masters were contracted to operate the vessels as no Barbadians had experience with operating a large longliner. The rest of the crew is all Barbadian. The vessels are deployed in the central Atlantic, primarily for tuna (yellowfin and bigeye). The tuna catch is chilled onboard and air-freighted immediately after landing to the United States for distribution by Phillips Seafood and Mitsubishi Corporation Food Division in the U.S. and Japanese markets. The company had planned to ship 15-20 t of tuna annually once its two longliners were fully operational. The bycatch was to be sold on the domestic market.[198] The company's local marketing arm is Morgan's Fish House. Fishing operations out of Barbados, however, proved disappointing. The company decided in late 1995 to lease the two longliners to Brazilian companies for operations off Brazil. The company was dissolved because of financial losses. One vessel sank and the other seized by the Barbados Development Bank.

Fish of Barbados: Fish of Barbados initiated operations in 1985, at Bridgetown near the fishing port. Their primary activity is processing the catch of the local fishermen for domestic sales. The major species handled are flyingfish and dorado. The company in 2000 had 30 employees. The company also buys small quantities of tuna, swordfish, and billfish for sale to local tourist hotels and restaurants. They also handle the export of the longline catch to the United States. Fish of Barbados began dealing with the longliners in 1996. At the time there were only three. The company now deals with 16 longliners and are the dominate shipper used by the Barbados longline fleet. They handle both tuna and swordfish, but prefer to market tuna as swordfish prices in the United States have been unstable in recent years. The company reported exporting monthly about 150 t of fish, mainly tuna, in 1999 to the United States.[199] They reportedly have an accurate grading system so the fishermen have a relatively good idea what their fish will bring on the U.S. market. The company primarily deals with Floribbean Wholesale Inc. in Miami. They finance the bait and supplies for the fishermen and charge a fixed fee for handling all gains being passed on to the boat owner and/or crew.[200]

Morgan's Fish House: Morgan's concentrates on flyingfish and does not normally handle swordfish and other oceanic pelagics. Morgan's buyers have noted very poor quality billfish from Trinidad, fish taken by the Taiwan longliners.[201]

Photo 51.--The large Barbadian longliner, "King of Kings," in September 1999 was prominently moored in the Careenage at downtown Bridgetown with a large "for sale" sign. Dennis Weidner

Ocean Fisheries Ltd.: Ocean Fishing was founded in 1990. It reportedly the second largest seafood processing company in the Caribbean. The processing plan is located at the Warren Industrial Park, west of Bridgetown. Six trucks bring the fish from the fishing port to the plant. Two are flat-bed trucks transporting the fish in ice containers and four are refrigerated trucks. There are three cold stores, two 115 t and 40 t chambers. The larger chambers are used to store raw material and the smaller one for finished product awaiting distribution. They primarily process flyingfish, dorado, king mackerel, and tuna, but handle about 160 different seafood species and products. The primary product, however, is the large flyingfish catch landed by local fishermen. The company reports that Barbados fishermen in 2000 have been supplying less dorado and king mackerel. This is somewhat surprising as neighboring islands (Grenada and St. Vincent) have been reporting improved catches of these species. Company officials are unsure as to whether the Barbados fishermen are catching less or are developing other marketing channels with less demanding quality requirements. Ocean Fisheries handles 4.0-5.5 million flyingfish annually. The company reports that they are the Barbados company with the greatest experience in producing frozen fish. Most of their raw material is supplied by local fishermen and their production is mostly sold domestically. The company indicated that they have been able to supply orders with domestically caught fish and have not had to import. The flyingfish fishery is highly seasonal. Ocean Fisheries, as a result, operates its processing lines on a seasonal basis--usually about 7 months each year. They are now studying the possibility of expanding operations to 12 months. Part of the production, however, is frozen and the company can thus provide fish on a year-round basis. They also run a small-scale export operation to supply seafood to other Caribbean islands, primarily Grenada, St. Lucia, and Trinidad--but is interesting in expanding sales to other CARICOM countries. Ocean Fisheries also handles the fish transhipped at Bridgetown by U.S. longliners. They also work with three domestic longliners. Their tuna catch, if possible, is sold locally because of the problems with exporting, but they do export as well. Virtually all of the other species (swordfish, billfish, and shark) taken by the longliners are sold domestically. The company reports that these species are quickly purchased by tourist hotels and restaurants when available. The most popular sharks in the local market are makos and blue peters.[202] The company charges about a 10 percent fee for exporting. Some fishermen, however, are dissatisfied with the grading. One fisherman reports that fish shipped to the United States were graded lower by the U.S. buyers than the initial Ocean Fisheries grade. The fisherman claims to have paid higher fees that the product eventually sold for.[203] Ocean Fisheries would like to develop new markets. They are especially interested in the European market where they think they can get better prices than in the United States. They are especially interested in marketing flyingfish to the large West Indian population in England, but are also exploring the possibility of exporting tuna and swordfish to Europe.[204] They are considering importing fish, but the tariff is 145 percent which makes such product extremely expensive. They are also interesting in aquaculture and are contacting Taiwan companies working in Grenada about possible joint ventures.[205]

Shamrock Trading: This company is one of the companies handling seafood. No information is available on its facilities or activities.

Simmons: Timothy Simmons and his brothers purchased a longliner, the *Mar Grace 1*, in 1997. It is 70 ft long and has a 20 t hold, one of the larger Barbados longliners. An American captain was hired to operate the vessel. Conflicts developed, however, between the American captain and the crew--resulting in a near mutiny. There were a variety of cultural problems. One of the many difficulties was reportedly how to distribute the proceeds of the catch.[206] A particularly good swordfish catch was reported by the American captain, but the product quality was poor, apparently due to inadequate processing procedures. A Barbados captain now operates the vessel. Sonar equipment was being added to the vessel in 1999, but, as other Barbados boats, it does not use satellite imagery. The captain conducts both day and night sets. No light sticks are used. About 70-80 percent of the catch is normally tuna. Small amounts of swordfish, billfish (mostly blue marlin), and sharks ("lion" shark and a few makos) are also landed. An average trip might result in about 70 tunas and perhaps 5-6 swordfish.[207] Catches in 1999 and 2000, however, have been generally disappointing. The company reported that through April in 2000 no swordfish had been taken.[208]

Photo 52.--The three largest Barbados fish markets are located at Bridgetown, Oistins, and Speightstown. Mark Farber

XII. Markets

A. Domestic

Barbados consumers appreciate seafood. Consumption rates are higher than in most other Caribbean countries. Barbadian consumers have a strong preference for fresh fish. Some Barbadian consumers do not even like fish to be iced, let alone frozen.[209] When iceboats were introduced during the 1950s, most consumers continued to prefer the fish landed by day boats. Consumers in recent years have gradually accepted the fish landed by the ice boats.[210] Some of the most common species in Barbadian markets include tuna, shark, red snapper, flyingfish, wahoo, barracuda, and dorado. The flyingfish is caught in the greatest quantity and is an important part of the Barbadian diet.[211] Availability of fish varies greatly and is highly seasonal. The authors September 1999 visit to Bridgetown and Oistins found most of the market stalls empty. The stalls that were open had flyingfish, which the vendor claimed was imported from Trinidad, and a few tunas and sharks. Even less fish was variable at Oistins.

The Barbados fishing industry still suffers from an inadequate distribution system, limited processing facilities, and unstable prices. The problems are enhanced because consumers are reluctant to buy iced or especially frozen fish. Fishermen and fishing companies are restricted as to the amount of care devoted ~~to~~ product quality. Seafood prices can easily rise beyond the price point of low-income consumers, significantly reducing the potential market. The limited distribution system beyond coastal areas is another problem.[212] The seasonality of the fishery, however, may be the industry's greatest challenge.

Substantial price fluctuations are an especially serious problem on Barbados. Fishermen are adversely affected by gluts of fish during the peak fishing season when prices plummet. There are about 200-500 vendors/hawkers.[213] The number varies as hawking seafood is highly seasonal on Barbados because of the seasonal availability of product. Consumers face serious shortages during the off season when seafood is scarce and often expensive. Declining catches in recent years from heavily fished inshore waters have caused additional problems.[214] Some of the difficulties have been alleviated to some degree in recent years by the acquisition of longer range vessels and improved marketing and storage facilities.[215] Even so, the availability of seafood on Barbados continues to be highly seasonal.

Oceanic pelagics are available in local markets. The Barbados longliners primarily sell to one company, Fish of Barbados. This company sells domestically as well as imports and exports fish.[216] The company reports that there is a strong market in Barbados for the longline catch. This is part due to the country's large tourist industry. Foreign tourists often request species like tuna, swordfish, and dorado. The increasing supply of these species in local markets has also stimulated local demand. Barbados has a relatively high standard of living compared to many other Caribbean islands and there is a strong local market for seafood. In addition, billfish which can not be exported to the United States can be sold locally.[217]

The domestic market is not the preferred market, especially for tuna, as higher prices are generally available for high quality fish in export markets. Limitations exist, however, on export markets.

Photo 53.--Barbados fishermen land their catch at Bridgetown where it is packed in these insulated boxes and then trucked to markets throughout the island. Dennis Weidner

exported. Some product was sold directly to hotels (appendix D). Many hotels, however, were reportedly very price conscious. As a result most of the fishermen focused on the export market.[218] This may have changed somewhat, however, with the growth of the longline fleet and the greater, although still seasonal, availability of swordfish. There is now a larger supply of fish and some of it does not meet export grading. Often this may be fish that is perfectly good product, but the trunk may be damaged. Such product would be sold domestically. Exporters experiencing wide price fluctuations and increasing complications have had some success in expanding domestic swordfish sales in 1999 and 2000. One company reports that they are easily able to sell swordfish domestically.[219] Another company reports that it is no longer very profitable to export swordfish to the United States, but continues as a service to the longline fishermen.[220]

Billfish, for example, can not be exported to the United States. Swordfish with mercury content above the FDA-set minimum also can not be exported. Exporters have also experienced increasing problems, such as fluctuating prices, with exporting swordfish. The tuna which can not be exported is marketed domestically as well as the billfish catch and some sharks.

Swordfish: Swordfish in the early 1990s was not generally sold at local markets. Most of the catch was

Billfish: The United States prohibits the importation of billfish taken in the north Atlantic. Thus the export option is not available for billfish. The Barbadian billfish catch is marketed domestically, although at prices below that of tuna and swordfish (appendix D). In fact, domestic fishermen can not fill the strong local demand. Barbados longline fishermen take both sailfish and marlins, but consumers prefer the marlins. It was not particularly popular as the local consumers were not familiar with how it is cooked. The growth of the longline fishery, however, and greater availability has increased consumer acceptance. One Barbados company reports that the

Photo 54.--Fresh tuna and shark landed by the longline fishermen is usually available year round at the public market adjacent to the Bridgetown fishing port. Dennis Weidner

billfish bycatch of the domestic longline fleet sells well in local markets.[221] It also sells well in tourist hotels and restaurants as well as the grilling stands at Oistins and other locations. During the offseason, billfish available in the local markets may be frozen product obtained from Taiwan longline fishermen transshipping product on Trinidad and St. Maarten.[222] Barbadian fishing companies report that some of this imported billfish is very poor quality product.[223] The imported billfish is used to supply institutional food service programs like school lunches and hospitals.[224]

Tuna: Tuna from an early stage in the development of the Barbados longline fishery was the principal target species. Some tuna is sold domestically (appendix D). Much of the tuna catch, however, is exported. Tuna exports are normally 3-4 times that of swordfish shipments (appendix E2b). Product handling is a particular problem with tuna. Barbadian companies can not meet Japanese quality standards for sashimi grade tuna and the location of Barbados complicates air shipment to Japan. One company reports that growing demand for fresh tuna in the United States means, however, that most high quality product is exported. Tuna has become Barbados' principal seafood export.[225] Another company reports very strong domestic sales to the tourist hotels and restaurants.[226]

Shark: Bermuda's small shark catch is marketed domestically. Shark has traditionally been a low value species not highly prized on the local market.[227] Consumer attitudes have changed little in recent years.[228] In the 1990s, shark was generally some of the least expensive fish available in local markets (appendix D). The common negative perception of shark is one factor. Another factor is the care with which sharks must be handled after they are caught. It is necessary to bleed and carefully handle shark because of the high urea content in their tissues which can lead to the build up of ammonia compounds--tainting the smell and taste of the fish. This is time consuming and not always done properly when a good catch is being retrieved. As a result, some poor quality, improperly handled product has been marketed in Barbados, affecting consumer attitudes. As a result, of the low prices, fishermen may cut sharks off the line rather than boat them.[229] One company reports, however, that some sharks sell well in Barbados, especially makos and what Barbados fishermen refer to as "blue peters".[230]

Seafood prices are fairly standard in Barbados. Most of the species landed by longline fishermen in 1999 were selling at the retail level for about US$3.30-6.60 per kilogram. Swordfish is rarely available in the local market. The abundant flyingfish sells for less.[231] Dorado ("dolphinfish") is also available as it is the other principal species taken by the local fishermen. Much of the dorado catch is taken by the ice boat rather than the longline fishermen.

There are several major Barbadian outlets for the oceanic pelagics. Because of the tendency to export most of the swordfish catch, it has not as available as the other species taken by the longline fishermen. Swordfish export prices, however, have been weak in recent years and the domestically availability has improved. The most available species, of the large oceanic pelagics, however, is billfish--especially marlins.

Dockside: An unknown quantity of longline caught fish are sold dockside. This fish is mostly sold as fresh H&G product

Markets: Oceanic pelagics are regularly found in local markets. The fish is fresh and customers simply select the amount desired from the large carcasses.

Super markets: Many supermarkets offer tuna and billfish, usually frozen product.

Hotels and restaurants: Hotels and restaurants catering to tourists often offer tuna and billfish dishes.

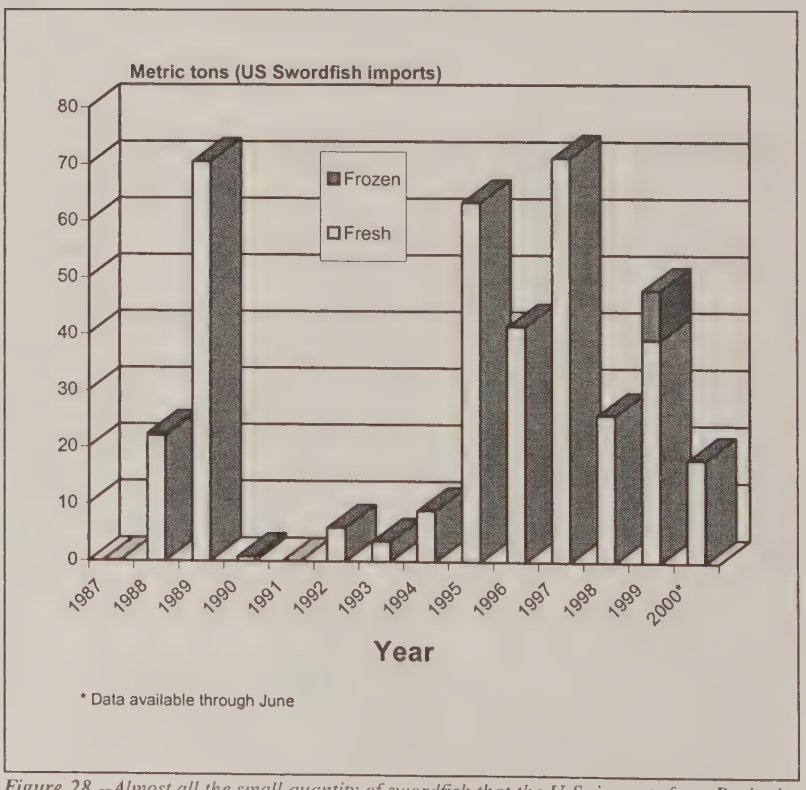

Figure 28.--Almost all the small quantity of swordfish that the U.S. imports from Barbados is fresh product.

Institutional food services: Billfish is sometimes purchased for use in school lunches and other institutional programs because of its low price. Usually this is imported product from the Taiwan transhipping operations on Trinidad and St. Maarten.[232]

B. Trade

1. Exports

Barbados' principal fishery export is flyingfish sold to ethnic markets in Canada, the United Kingdom, and the United States. Barbados exports of swordfish are currently minimal, although small quantities were shipped during the late 1980s. Shipments to the United States in the 1990s have been quite small--much smaller than suggested by U.S. import statistics which include transhipped fish landed in Barbados by U.S. fishermen.[233] All known swordfish exports have been to the United States (appendix E1). Small shipments to the United States were reported in 1988 (22 t) and 1989 (71 t), but not all of this swordfish was caught by Barbados longline fishermen (appendix C3c1-2). Shipments during the early 1990s were quite small, but increased in the late 1990s. Most of those shipments, however appear to be transshipped U.S. caught fish (appendix C3a2).

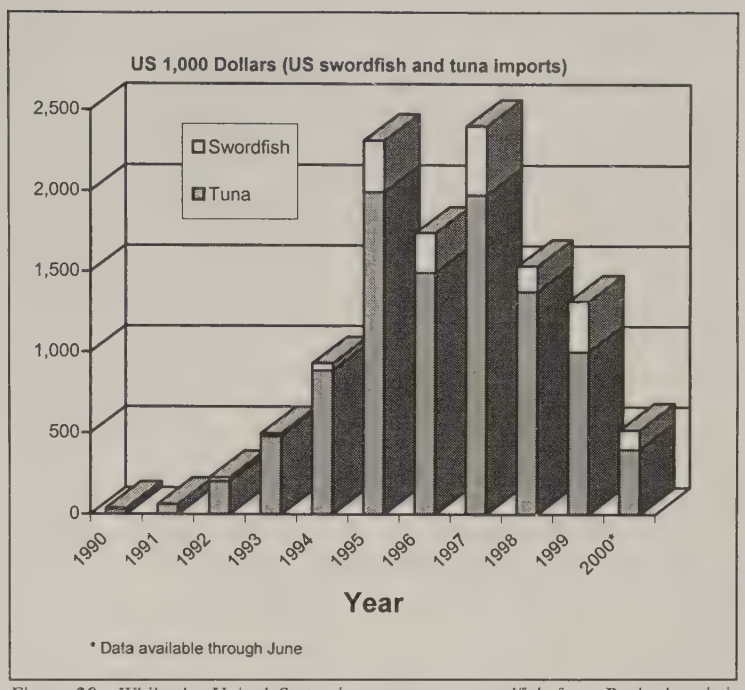

Figure 29.--While the United States imports some swordfish from Barbados, it is importing much larger quantities of tuna.

Barbadian fishermen complained in 1988 that the U.S. Food and Drug Administration (FDA) was discriminating against Barbados by rejecting swordfish shipments from Barbados, but accepting swordfish caught by U.S. fishermen in the same waters.[234] One Barbados fishermen claimed the FDA rejected his shipment of 2.3 tons.[235] Most of the swordfish involved appears to have come from operations of joint ventures with U.S. fishermen formed in the late 1980s. Food and Drug Administration (FDA) officials insisted that the minimum mercury content regulations apply to U.S. as well as foreign-caught fish and are applied in a non discriminatory manner. FDA has an automatic detention procedure which applies to all swordfish imports--except sources (shippers) with a previously established history of supplying swordfish meeting the mercury standard.[236] FDA officials report that under the automatic detention procedure U.S. fishermen operating in international waters are affected when landing fish at a foreign port, just as the foreign fishermen.[237]

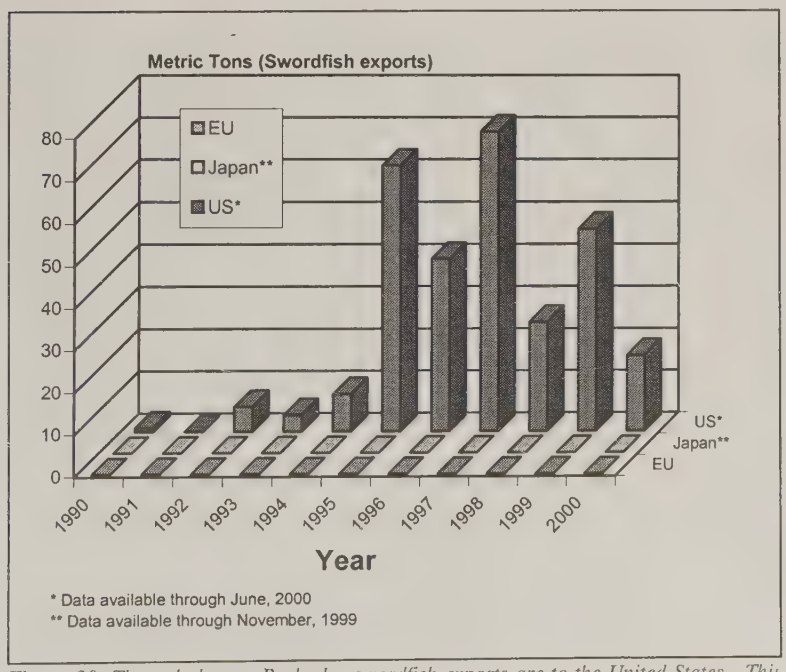

Figure 30--The only known Barbados swordfish exports are to the United States. This peaked in 1997 with around 70 tons.

Barbados swordfish exports during the 1990s have been very limited and appear to be entirely shipped to the United States. Some increase activity has been reported since 1995, but this appears to be mostly U.S. transshipments

rather than Barbadian-caught fish.

United States: Shipments to the United States were very limited in the early 1990s, ranging from nothing in 1991 to 9 t in 1994 (appendix E2a1). This situation changed significantly in 1995 when 63 t were imported by the United States. Shipments in the second half of the 1990s ranged from a low of 26 t in 1998 to high of 71 t in 1997. These shipments, however, do not appear to be Barbadian-caught fish. Barbadian officials report that they are mostly U.S.-caught fish transshipped through Barbados.[238] (See "Transshipments.") Manifests often do not indicate the flag of the vessel which caught the fish. Thus swordfish shipped from Barbados are reported as imports from that country by U.S. Customs, despite the fact that the fish were taken by U.S. fishermen. Barbadian officials have provided detailed data concerning the origin of the swordfish shipped from Barbados during 1996 and 97 (appendix C3c2). U.S. import data show that shipments were very limited in the early 1990s, ranging from only nil (1991) to 8.9 t (1994) annually between 1990 and 1994. More sizeable shipments were reported in the late 1990s, in part, because of the impact of Barbados' growing longline fleet. Shipments to the United States peaked at over 70 t in 1995, but only about 40 t in 1999 (appendix E2a1). Much of that fish, however, in most years was transhipped U.S.-caught fish (appendix C3a2). The COE data that is being compiled will provide detailed data on the origins of fish shipped from Barbados and other countries, but the data at this time is only preliminary (Caribbean Overview, appendices F2e1a-c).

Japan: There are no known Barbados swordfish shipments to Japan. Barbados fishermen catch several species which could be marketed in Japan (tuna and billfish), but apparently no company has yet mastered the quality standards and developed the marketing contacts to enter the Japanese market.

European Union: There are no known shipments to the European Union. Barbados companies frustrated with the complications associated with entering the U.S. swordfish market, talk about possible European sales. Barbadian officials report, however, that they soon find that the European market is even more difficult to enter.[239]

Swordfish shipments are a relatively minor part of the country's fishery exports. The longline fleet's principal target species is tuna and as a result it is tuna which constitutes the bulk of the country's seafood exports. Tuna exports in 1997, for example, totaled $2.0 million, compared to only $0.4 million of swordfish. As with swordfish, however, much of that product is fish transhipped by U.S. longline fishermen.

2. Imports

The authors know of no Barbadian swordfish imports, although some U.S. fishermen occasionally tranship swordfish through Barbados. (See: "Transshipments.") Barbados does import billfish, mostly marlin. Fishery officials estimate that imports total 400-600 t annually, mostly frozen trunks (logs).[240] The primary source is the Taiwan transhipping facility at Port of Spain, Trinidad. Lesser quantities are imported from the Japanese facility at St. Maarten.[241] The billfish was being imported at about $2.20 kg and sold for about $3.30 per kilogram. It is widely used for institutional food programs like hospitals and schools.[242] Barbados officials and seafood importers note that much of the imported billfish appears to be very poor quality product.[243]

Billfish imports in Barbados have been handled through licensing arrangements. The Government in 2000 is studying changes in this system. Officials are considering the introduction of tariffs on billfish imports. The level of those tariffs, however, have not yet been determined.[244]

Photo 55.--The longline catch destined for export is packed in insulated cardboard boxes with dry ice at the Bridgetown fishing port and then trucked directly to the airport. Chris Parker

XIII. Government Policy

The Barbados fisheries agency is the Fisheries Division (FD) in the Ministry of Agriculture, Food and Fisheries.

A. Fisheries law

The Barbados Government began to study a new fisheries law in 1990 which among other matters created an advisory board with fishermen and other industry representatives to advise on management.[245] The Barbados House of Assembly in 1993 passed the new Fisheries Act which is similar in many respects to the harmonized legislation drafted by the Organization of Eastern Caribbean States (OECS) with FAO assistance.[246] The OECS has succeed in having all member states enact the harmonized law (for details see: 2.0 "Caribbean.")

Barbados has issued no regulations on either longlining or swordfish fishing. Barbados fishermen do have to obtain fishing permits and at that time they indicate what gear they will deploy. Government policies currently promote the expansion of fisheries targeting offshore pelagics and thus the approval of such permit requests is perfunctory. Some industry sources, especially in the recreational industry, are critical of the Government's failure to regulate the longline fishery.[247]

B. Limits

Barbados established a 12-mile Territorial Sea in 1977. The same act provided for archipelagic straight baselines.[248] The Government proclaimed a 200-mile Exclusive Economic Zone (EEZ) in 1979.[249] The country signed the Law of the Sea Convention in 1982 and ratified it in 1993.[250]

C. Licensing

1. Commercial

Legislation passed in 1978 gave the Barbados Government authority to issue fishing licenses and set fees and issue regulations governing grounds, trips, quantities, methods, ports, catch utilization, and other matters.[251] Fishermen have to register their boat, but do not need licenses specifying the specific species to be targeted. There is a small fee required to register the boat.[252]

All non-Barbadian fishing boats require a fishing permit to operate in the country's 200-mile EEZ.[253] A Barbadian boat in legal terms is defined as any boat that is wholly owned by Barbadian citizens, directly or indirectly through shares in a corporation. Exceptions can be made in the case of substantial economic connections if certified by the Cabinet. Barbados has some regulations referring to foreign fishing which are detailed in the Marine Boundary and Jurisdiction Act.[254] Penalties for violating the foreign fishing regulations include fines up to $25,000, imprisonment up to 5 years and possible forfeiture of the vessel, gear, and catch.[255] The Act does not, however, establish fees for foreign fishing or administrative mechanisms for managing foreign fishing. Applications from interested foreign fishermen are thus dealt with on an *ad hoc* basis.[256] The Government was considering regulations for foreign fishermen in 1988, but no details are available on any actual regulations issued. The authors know of no foreign countries which have actually purchased Barbadian licenses.

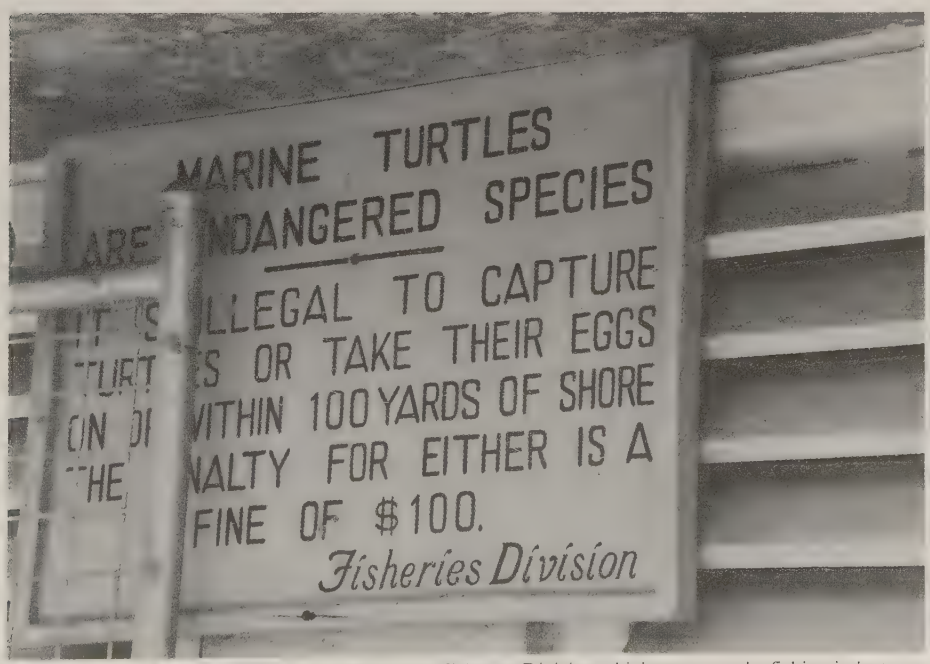

Photo 56.--The Barbados fisheries agency is the Fisheries Division which manages the fishing industry as well as protects endangered marine animals like turtles. Dennis Weidner

One local observer in 1987 indicated that Barbados officials would be unlikely to issue fishing licenses to foreign fishermen that would compete with domestic fishermen. Barbados officials, however, might be willing to issue licenses for "deep-sea" fishing if the foreign concern was considering investment in shore-based processing facilities. Unconfirmed reports suggest that Barbadian authorities might consider foreign fishing requests for offshore licenses as part of an arrangement involving investments in shore-based processing or freezing facilities.

2. Recreational

The Barbados Government issues licenses for recreational boats, charging a nominal fee. Anglers on a licensed recreational boat do not need individual licenses.[257]

D. Management

Barbados published its Fisheries Management Plan in 1997. It is one of the first Caribbean countries to publicly release such a management plan. Fishery officials report that a great deal of effort went into the plan and obtaining industry input.[258] The Plan has detailed information summarizing basic data, summarizing the fishery, and listing regulations. In this regards, Barbados Chief Fisheries Officer, Patrick McConney has insisted on regulations that are clearly needed and enforceable. He explained that "Here in Barbados we do not believe in *decorative* regulations."[259]

The Barbados Plan includes action statements describing how to implement the Plan. The FD suggested an action plan consisting of seeking access to fishing grounds, encourage formation of a regional decision-making mechanism for fishery resources, and to improve the FD's research data collection program. The FD stresses the need for additional staff to improve the Division's research and data collection system. The Management Plan included a sub-plan for large pelagics (appendix H). It is the only such plan known to the authors yet implemented by Caribbean countries. The Barbados plan is a multi-species approach with target species including tunas, wahoo, billfish, dorado, swordfish, and mackerel. Shark is listed as the only bycatch. It is less detailed than some of the others, in part because Barbados does not have the capability to seriously research the highly migratory target species (tunas, swordfish, and billfish), although data collected in Barbados would make a valuable contribution to the overall ICCAT research effort. Barbados research have done some work on species with a more localized regional migratory pattern (dorado and wahoo).[260]

The FD is now preparing an update of the 1997 Management Plan. The Plan will cover the same species with the addition of conch.[261] Some revisions may be made to the large-pelagic sub-plan, especially if Barbados, as planned, enters ICCAT in 2000.

E. Promotion

Government officials have some time been interested in using available marine resources to more fully supply the domestic market for seafood. Prime Minister J.M.G. Adams indicated in 1979, for example, "we're trying to do our best with fisheries development to ensure that even with the big appetite for fish that we have in Barbados can be satisfied by local efforts."[262]

The Government has pursued a variety of policies to assist the industry.

Fishing ports: The Government fisheries development program has included important project to expand and improve fishing ports and the facilities available to the fishermen. The two largest port projects have been the construction of modern

Photo 57.--Statistics on the longline catch are collected at the Bridgetown fishing port by staff of the Fisheries Division which is conveniently located alongside the port. Chris Parker

facilities at Bridgetown and Oistins, but other smaller landing sites have also been improved. (See: "Ports.") Mooring is free at these ports as are services such as water. Ice is provided at discounted rates to domestic fishermen.[263]

Extension program: The FD has one of the most active fisheries extension program in the eastern Caribbean.[264] The Government has exempted the fishermen from taxes on diesel fuel, rebated taxes paid by the inshore fishermen on fuel, organized an insurance scheme, developed training programs, provided an annual maintenance subsidy, furnished electricity free at maintenance sites, and assisted marine mechanical services.[265]

Maintenance: The FD maintains a Marine Maintenance Section for boat repairs and inspection and has tractors to haul artisanal boats out of the water. The free maintenance services were ended in 1998.[266]

Financing: The Barbados Development Bank (BDB), a state corporation, during the 1990s played an important role in providing credit to the fishing industry. Loan approvals vary, but totaled $1.2 million in 1993.[267] The BDB contracted for technical reports to assess the Barbados potential for longlining.[268] The BDB approved loans to finance the purchases of two large longliners in 1992, the *Colleen Cheramie* and the *King of Kings*. The project did not prove successful and the boats were eventually repossessed.[269] One of the vessels sank (*Colleen Cheramie*) and the other (*King of Kings*) in 1999 was sitting at the Careenage in downtown Bridgetown with a large for sale sign. The BDB ceased operations in 1998 and financing is now handled by commercial banks or the Caribbean Development Bank.[270]

Gear development: The FD assisted Barbados fishermen entering the longline fishery in the late 1980s and 1990s, contracting test fishing, conducting some gear tests, and helping to obtain duty free concessions for the import of vessels and equipment.[271]

Subsidies and concessions: The FD offers a variety of subsidies to the fishermen. Some pertain primarily to the artisanal fishermen, but the commercial longline fishermen also benefit from many of these subsidies. There are tax and duty free concessions on fuel, boats, spare parts, and related supplies. Fishermen are eligible for reduced tractor fees when hauling out their vessels. There is an annual maintenance subsidy of up to $150 per boat. There are no fees for registration, licensing, inspections or other administrative services.[272]

Test fishing: One of the most important programs to assist Barbados fishermen in entering the longline fishery has been test fishing to acquire basic data on the resource available and the success of different fishing strategies. The FD has sponsored test fishing programs to acquire information for Barbados fishermen on potential results from longline operations in the south eastern Caribbean. Two test fishing projects were conducted in 1988-89:

KristinLee/Janice Ann: These two U.S longliners were allowed to operate out of Bridgetown and land their catch there on condition that detailed catch and effort data was submitted to the FD. Both longliners were 15 m long with 9 t holds. They targeted swordfish in an area about 120 km west of St. Lucia and St. Vincent. They deployed longlines of about 50 km with 300-360 hooks per set. They reported a substantial swordfish catch with a bycatch of tuna and other species (appendix B4).[273]

Taygits: This 12-m fiberglass longliner had a 9 cubic meter hold. The vessel was equipped with video echo sounders and satellite navigator. Most fishing was conducted close to the Barbados coast (40 km radius). A 10-km longline was set with 100 hooks, 8-11 hooks per kilometer, with chemical light sticks. The project reported catching 2.4 swordfish per set, 3.8 swordfish per 100 hooks, but rather small sized fish. The mean size of swordfish was 23.6 kilograms. The bycatch in terms of weight was mostly shark (84 percent) and tuna (12 percent). The swordfish catch was lowest in the first month of the project (October), but increased as the project continued (through January).[274]

The FD sees swordfish and other oceanic pelagics as an opportunity for fisherman to diversify from their dependence on flyingfish and dorado. Ministry of Agriculture and FD officials have actively encouraged the fishermen to target swordfish and related species.[275] The FD is concerned, however, about difficulties exporters have experienced entering the U.S. market. (See: "Markets".) The FD offered advise to exporters in 1988 affected by U.S. import regulations prohibiting shipments with high mercury levels. The FD advised exporters to ensure that each consignment include more small fish (which normally have relatively low mercury levels) than larger fish. FD officials advised exporters that "Such a policy should ensure that the average mercury level reads less than 1 ppm."[276]

XIV. Research

Various Barbados research groups have done a substantial amount of fisheries research, focusing on the species of greatest interest to local fishermen, including several oceanic pelagics such as flyingfish, wahoo, and dorado. Researchers have, however, carried out only limited work on the highly migratory species. [277]

Bellairs Research Institute (BRI): BRI conducts multi-disciplinary research and teaching programs on tropical issues. Active research projects include marine ecology, applied fisheries biology, pollution impacts on coral reefs, and environmental assessments and monitoring. The BRI is supported by Canada's McGill University and the Canadian International Development Research Centre (IDRC). The Barbados Government contracts out much needed research on health and environmental issues and BRI is a primary contractor. BRI has done some work on flyingfish, including some genetic work. Research on oceanic pelagics has been more limited.[278] Researchers have maintained historical data on billfish catches, but early records were not broken down by species.[279] BRI focuses heavily on environmental and ecological studies. There is one primary fisheries researcher who has worked primarily with reeffish. The BRI has conducted shore sampling of the artisanal, small commercial, and recreational fisheries for billfish. The BRI with ICCAT assistance had hoped to begin some at-sea sampling during the 1990s.[280] This, however, did not prove possible.[281] Most of the research effort during the 1990s has been sampling recreational billfish tournaments. Tag and release activities at these tournaments were initiated in 1986 and continue to expand.[282] The BRI also sponsors the Barbados Sea Turtle Project and is the leading Barbados research group working on turtles. BRI researchers have published an extensive series of reports on sea turtles on Barbados.[283] The only BRI work on swordfish was an assessment of the fishery for the Barbados Development Bank which at the time was considering loan applications for longline projects.[284]

Coastal Zone Management Issue: The Coastal Zone Management Unit of the Ministry of Health and Environment sponsors some research on inshore species, but no work on oceanic pelagics.

Fisheries Division: The Government Fisheries Division in the late 1980s conducted trials with artisanal (4 km) longlines which FD researchers developed. FD reported that the ice boat *Kings Ark* deployed a longline in experimental trials on grounds 16-24 km south of the island during 1987-88. Squid was used for bait. The FD reported catching a billfish, a swordfish, and a small escolar as well as various bites and damage to the wire trace.[285] The FD during the 1990s has also worked with CARICOM and ICCAT researchers, primarily to collect data on large pelagics.

University of the West Indies (UWI): The University of the West Indies at Cave Hill conducts some marine research. The staff, in many cases, are the same individuals working at BRI. The UWI staff in 1994 conducted a long line study, in collaboration with the BRI, under contract with the Barbados Development Bank. The study examined the current status of longlining in Barbados and the potential for expansion. The report was prepared under contract to the BDB and thus is not available from the UWI staff who prepared it.[286] UWI has a variety of programmes studying oceanic pelagics. The UWI in 1992 initiated the National Resources Management (NRM) program. Funding was obtained for the program in 1998-99 from the European Union. The goal is to train national resource managers from Caribbean countries in the areas of marine resources management, research skills, and reporting. The Program seeks to expose future research managers in the use of scientific reports.[287] The Center for Resource Management and Environmental Studies (CERMES) programme, within NRM, currently has ongoing research focusing on flyingfish, dolphin and, wahoo which they classify as oceanic pelagics. The programme also continues to monitor billfish landings at tournaments for the ICCAT billfish project.[288] The UWI in 1999 is conducting a study on the population genetics of wahoo and dorado ("dolphinfish"), two of the key species taken in the oceanic pelagic troll fishery.[289] The wahoo study is being conducted in collaboration with the Gulf Coast Research Lab in Mississippi. The dorado study is being conducted in collaboration with the South Carolina Department of Natural Resources (SCDNR). The Barbados study is part of a world wide project to assess the genetic structure of dorado. The issue being addressed is whether there are two separate stocks in the western Atlantic. It is being funded by the NMFS MARFIN Program.[290] UWI researchers in the Department of Biological and Chemical Sciences have also worked on flyingfish genetics during 1995-98.[291]

International organizations and foreign researchers have also provided some assistance with data collection systems needed for research and management.

CARICOM: The Caribbean Community's (CARICOM) Fisheries Resource Assessment and Management Program (CFRAMP) initiated a biological data collection program for large pelagics in 1995.[292] CARICOM also sponsored a variety of research studies, including some on pelagic species.[293]

Estación de Investigaciones Marinas de Margarita: The Venezuelan Estación de Investigaciones Marinas de Margarita (EDIMAR) has done oceanographic work around the islands of the southern Lesser Antilles.[294] EDIMAR has also done a great deal of fisheries work. The authors know of no work on swordfish, but there has been some work on tuna, significantly adding to the information available on tunas in the southeastern Caribbean as a whole.[295]

FAO: Barbados participated in the Caribbean Fishing Development Project funded by FAO in 1982.

ICCAT: The International Commission for the Conservation of Atlantic Tunas (ICCAT) began working with Barbados officials during the late-1980s as part of the ICCAT Enhanced Research Program for Billfish (ERPB). ICCAT stressed the need to evaluate available historical data and to expand current data collection. ICCAT has provided some funding for this effort.[296] ERPB program participants also assisted in obtaining information on tag recaptures.[297]

INO: The Spanish Instituto Nacional de Oceanografía (INO) has done considerable genetic research on Atlantic swordfish populations. INO's work has demonstrated that swordfish in the Mediterranean and south Atlantic are genetically different from swordfish in the north Atlantic.[298] The INO is now attempting to assess genetic variation within the north Atlantic and, in cooperation with the University of South Carolina, is planning swordfish sampling at Caribbean sites and in other areas of the western north Atlantic. The INO is seeking to obtain samples from Barbados.

IDRC: Canada's International Development research Centre (IDRC) has funded research, such as tagging flyingfish, conducted by BRI and the UWI.[299]

NOAA: The National Oceanic and Atmospheric Administration (NOAA) has done extensive oceanographic research throughout the Caribbean.[300] NOAA's National Weather Service is the principal agency involved with tracking the hurricanes that move into the Caribbean each year. NOAA's National Marine Fisheries Service through the Southeast Fisheries Science Center (F/SEC) does extensive work on many species of importance to Barbadian fishermen, although the authors know of no specific F/SEC work on oceanic pelagics in St. Lucia. NMFS researchers have taken samples of billfish and collected data at recreational tournaments.[301]

Universidad de Oriente: The Venezuelan Instituto Oceanografíco (IO) at the Universidad de Oriente in Cumaná has done substantial work on oceanography in the southeastern Caribbean.[302] IO biologists have also worked on fisheries, including swordfish and other highly migratory species. Much of this work is helpful in understanding swordfish behavior and trends around the islands of the Lesser Antilles.[303]

UM: Researchers at the University of Miami are conducting an extensive study of billfish and swordfish larvae in the Florida Straits and comparing the data with samples taken elsewhere in the Wider-Caribbean.[304] The UM researchers are especially interested in Barbados samples because billfish tagged off Florida have been taken off Barbados. UM researchers are working with the University of the West Indies to obtain samples.[305]

USC: The Department of Biological Science at the University of South Carolina is working with the Spanish INO to assess Atlantic swordfish populations. Department staff are trying to determine if swordfish in the eastern north Atlantic off Europe are genetically different from the fish in the western north Atlantic off the United States. Researchers believe that sampling the fish in spawning grounds off the Atlantic coast of Barbados would significantly add to the understanding of swordfish genetic diversity in the Atlantic. The researchers in 2000 were attempting to collect and assess fish taken off Barbados.[306] Such information would of course be of great value for fisheries management.

XV. Bycatch

The authors have no data on the bycatch of the Barbados longliners. Several of the bycatch species in directed swordfish operations are the target species of the Barbados longline fishery which targets tuna. Billfish is also taken in large quantities and important economically to the fishery as there is a strong market for billfish on Barbados. Both tunas and billfish are taken in much greater quantities than swordfish by Barbados longline fishermen.

A. Tunas

Tuna occurs in the wider Caribbean in substantial quantities. One FAO assessment in 1985 suggested that about 600 t of tuna could be harvested per 1° square in the southern Caribbean.[307] Tunas are not, however, a bycatch in the Barbados longline fishery, but rather are the principal target species. Tunas normally constitute over 40 percent of the longline catch in terms of quantity (appendix B2). Data from the fishermen have shown relatively constant tuna catch rates of from 0.4-0.5 t per trip (appendix B1). Particularly high catch rates were noted in 1996.

B. Billfish

Barbados artisanal and commercial fishermen have not traditionally taken large quantities of billfish. The catch appears, however, to have been quite varied. A report for one year indicated fishermen landing sailfish, white and blue marlin, and an occasional spearfish. While the sailfish and marlins were reported in approximately equal numbers, in terms of weight, blue marlin represented over half of the billfish catch.[308]

The species of billfish taken and the historic catch patterns appear to have been significantly affected by the introduction of longlining.[309] As the eastern central Atlantic have significant concentrations of billfish, longline fishermen from Barbados and other longline fishermen incidentally take billfish.[310] Some Caribbean fishermen target billfish as they are a popular food fish on several islands, including Barbados. Some Barbados longline fishermen in the early 1990s were making shallow sets during the day which would result in catches of up to 46 percent billfish.[311] Available data confirms that the country's longliners report a substantial billfish catch (appendices B1-2). The billfish proportion of the longline catch is exceeded only by the tuna catch. Longline fishermen report a billfish catch exceeding 25 percent of the overall catch (appendix B2). The level of the catch suggests that the billfish are not a bycatch, but an actual target species. Billfish are a popular food on Barbados and thus the billfish catch provide an important part of the revenue reported by the longline fishermen.

The principal billfish species taken in Barbados is sailfish. One Barbados report published in 1994 suggested that sailfish accounted for nearly 70 percent of the Barbados billfish catch.[312] Billfish catch data available from ICCAT shows that while sailfish is still usually the principal species caught, the relative importance of sailfish has declined to only 40-50 percent (appendix C4).

Confirmation of Caribbean bycatch trends are available by assessing the data reported by the U.S. longline fleet in its Caribbean operations (Puerto Rico, appendices G1a-b).[313] While these data do not

Photo 58.--The acquisition of monofilament gillnets has increased the efficiency of artisanal fishermen throughout the Caribbean, and the potential for bycatches. D. Weidner

pertain specifically to Barbadian waters or the fishing strategies used by Barbadian fishermen, they do provide useful benchmark data. This is especially true as Barbadian fishermen generally use U.S. gear and some of the fishing strategies developed by U.S. fishermen.

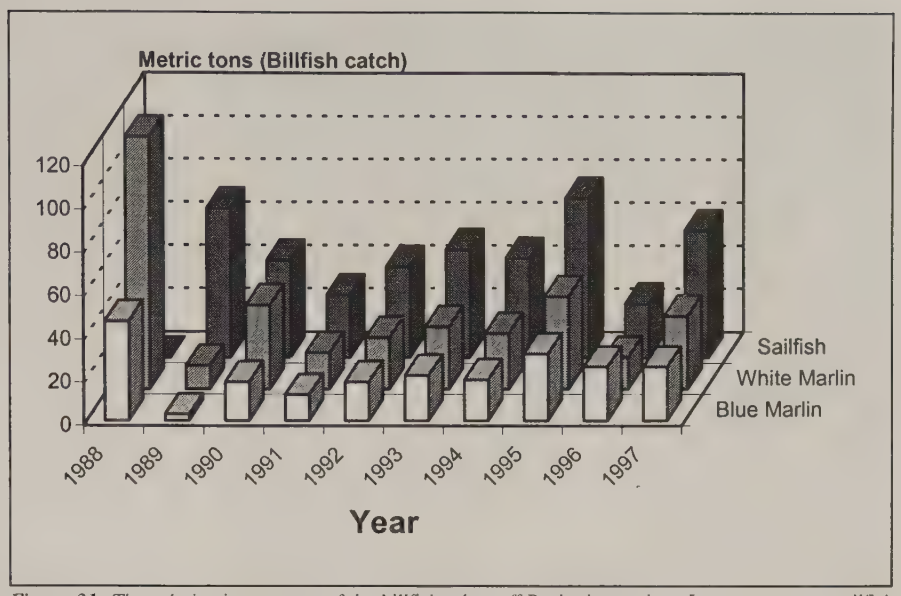

Figure 31--The relative importance of the billfish taken off Barbados varies. In recent years, sailfish have been the most important.

The sport fishermen are extremely concerned about the declining billfish catches they report experiencing over the past 3 years. One fisherman blames the domestic longline fishery which deploys mainlines of 15-50 kilometers. They operate all year round and take a great variety of species. There are no restrictions on taking billfish in Barbados. The fishermen, as a result, land large quantities of juvenile fish, including billfish.[314] The BGFA believes, however, that shifting current patterns may be responsible for the poor billfish catches over the past 3 years. He points that the local Barbadian commercial and artisanal fishermen are also reporting very low catches.[315]

Available data from Barbados longline fishermen through 1998 does not show any precipitous decline in billfish catches. Billfish catch rates in 1994 were 0.2 t per trip, a relatively low level in the Barbados fishery, perhaps because fishermen were still perfecting their fishing strategies. Billfish catch rates from 1995-98 varied from 0.3-0.4 t per trip. The catch rate peaked at 0.4 t per trip in 1997, but was still at 0.3 t per trip in 1998 (appendix B1).

C. Shark

Some sharks are taken by both the artisanal and commercial fishermen. A few are also taken by the recreational fishermen. The Barbados longline fishery does not target shark. Because of the low value and generally small hold sizes, sharks are often not retained, but cut off the line as the fishermen report that they are often not worth the effort involved in boating and dressing the fish.[316] Fishermen report that less than 2 percent of their landings are shark (appendix B2).

Despite the lack of directed effort, there may be a considerable, but unknown incidental effort--largely wasted as so few sharks are retained. The Barbados Government reported a shark bycatch to ICCAT of 24 t in 1995.[317] This was probably, however, the shark bycatch landed and not sharks caught at sea and discarded. The Barbados officials report that there has been a steady decline in the shark fishery since the 1950s.[318] In recent years the country's shark catch has declined from 50 t in 1985 to only 14 t in 1997 (appendix C1b). Some higher catches of 90-135 t were reported in 1998-90. These figures are not actual catches, but rather the live weight of sharks landed. If actual catches, including the discards in the longline fishery, the Barbados shark catch would be much higher.

Data on shark catches including at sea discards are unavailable. Given that less than 2 percent of Barbados longline landings are shark (appendix B2), the discards at sea must be very sizeable. U.S. fishermen operating in the Wider-Caribbean, for example, reported in 1993 that about 9 percent of their catch was shark (Caribbean Overview, appendix G4a). Of course because the Barbados fishermen fish close to the island and use different fishing strategies, there shark bycatch will not be identical to the that reported by the U.S. fishermen operating in the Caribbean. It is an indicator, however, that the Barbados longline composition is almost certainly much larger than the 2 percent actually landed.

The authors have no details on the species of shark taken in the Barbados longline fishery. U.S. fishermen operating in the Caribbean during 1993 reported that blue and silky shark are the primary species taken (Caribbean Overview, appendix G4a). The species involved, however, can vary (appendix

Photo 59.--Dorado ("dolphinfish") are taken by both the artisanal and longline fishermen. These fish were landed at Speightstown. Martyn Melhuish

G1c1). While Barbados officials have no shark catch data by species, officials confirm that blue shark is the primary species taken.[319]

Shark meat is not very popular with Barbadians.[320] The meat was not traditionally sold in Barbados, but oil was produced from the liver.[321] Since the advent of the local longline fishery, shark now does appear in local markets, but usually is one of the least expensive species. The authors on a September 1999 visit, saw very little shark in the fish market. One species, the lion shark, appears to be appreciated because of its reported effectiveness as an aphrodisiac.[322]

D. Other finfish

Species reported as bycatches in many swordfish fisheries are in Barbados an important part of the longline catch. One important species is wahoo. Another important species is dorado ("dolphinfish").

1. Dorado

Dorado constitutes an important portion of longline landings in Barbados. As in much of the Caribbean, it is referred to locally as "dolphin fish". It normally constitutes about 10 percent of overall landings (appendix B2). Catch rates appear more varied than for other longline species. Fishermen reported CPUEs of from 68-174 kg per trip during 1984-98. Over the entire 1994-98 period, catch rates dropped from 118 kg to 88 kg per trip (appendix B1).

The seasonality pattern of dorado catches in the eastern Caribbean have led some fishermen to speculate that there are at least two distinct stocks of dorado in the eastern Caribbean, a "northern" and a "southern" stock. Researchers on Barbados used three approaches to assess the stock structure of dorado in the western central Atlantic: 1) commercial and sport fishing data from several countries to examine seasonality and size structure of catch throughout the region; 2) they compare growth, age/size at sexual maturity, fecundity, and egg size of dolphin from different parts of the region; and 3) they use electrophoretic techniques to compare dolphin sampled from Miami and Barbados, two widely spaced fisheries in the region.[323] Other research work on dorado off Barbados has been conducted.[324]

2. King mackerel

King mackerel are taken in small quantities. They constitute only about 1 percent of landings (appendix B2).

3. Wahoo

Wahoo are also occasionally taken by the longline fishermen. Data are, however, not available. The small quantity taken are either misidentified as king mackerel are included in an "other" basket category. The UWI in 1999 is conducting a research study on wahoo.[325]

4. Other species

A sizeable quantity of flyingfish are taken by the longline fishermen. Flyingfish is the major species taken in the overall Barbados fishery and very abundant around the island. Flyingfish constitute nearly 13 percent of the longline catch (appendix B2). Catch rates are highly variable ranging from 65 to 248 kg per trip (appendix B1). Very high catch levels of 248 kg per trip were reported in 1998.

Small quantities of other finfish are also taken by the longline fishermen. These other species normally constitute about 2 percent of the catch (appendix B2).

E. Turtles

Four species of sea turtles are found off Barbados. Hawksbills (*Eretmochelys imbricata*) are the most common and nest on the western and southern coasts, which unfortunately are the most heavily populated coastal areas of Barbados. The hawksbills appear to nest year-round, except for February and March. The population is relatively small. One 1992 report suggested that the annual nesting population was only about 50 hawksbills.[326] More extensive monitoring, however, in 1998 and 1999 suggests that the annual population is at least 100.[327] Hawksbills feed on coral-reef associated sponges. Unlike hawksbills that nest to the north (Antigua, U.S. Virgin Islands, Puerto Rico), Barbados nesters do not appear to be foraging in the northern Caribbean.[328] Leatherbacks (*Dermochelys coriacea*) nest off the east and southeastern coast, although only rarely--some being individuals who have for various reasons been diverted from their normal nesting grounds. Green turtles (*Chelonia mydas*) forage off Barbados, but do not nest. Loggerheads (*Caretta caretta*) are also occasionally reported, but little information is available on them.[329]

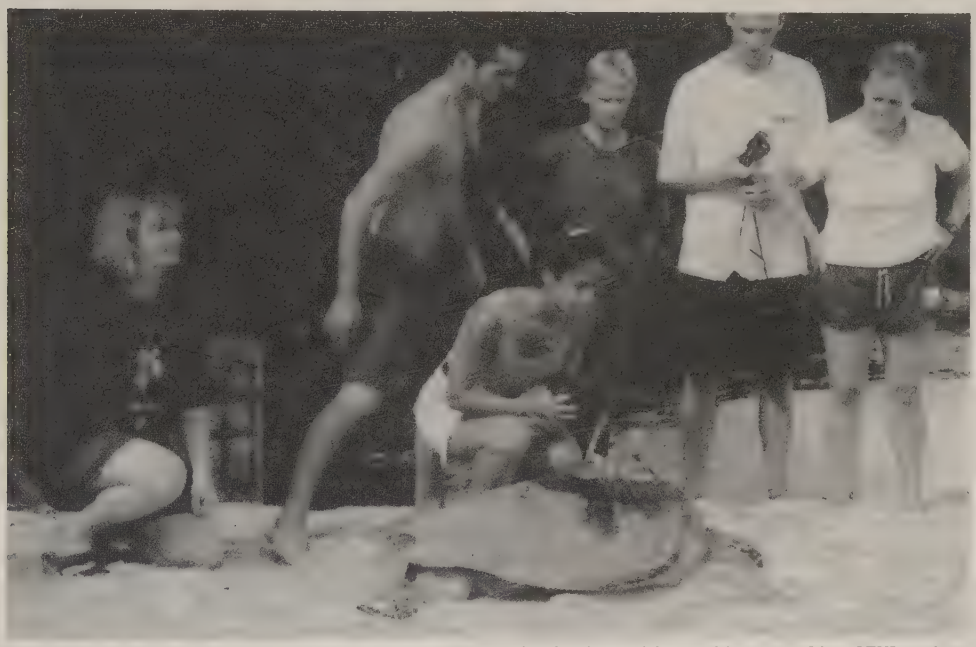

Photo 60.--Barbados turtle researcher, Dr. Julia Horrocks, is pictured here with some of her UWI students attaching a radio transmitter to a hawksbill turtle. George Balazs

The Barbados Government has attempted to protect turtles during the 1990s. The Government in 1990 considered a moratorium on harvesting sea turtles.[330] Fishermen had for years harvested both turtles and turtle eggs. Regulations were adopted making it illegal to capture turtles or eggs within 100 yards of shore. It was also against the law to buy, sell, or possess any turtle that weighs less than 30 pounds. Offenders could be fined up to $50 or face imprisonment.[331] The illegal capture of turtles (for shells and meat) and eggs, however, remained a problem in Barbados. The Government of Barbados has launched a public awareness campaign advising that the turtle is an endangered species. The Government in 1998 issued more restrictive regulations to protect turtles, placing a complete moratorium on harvesting or selling turtles and turtle eggs, both on shore and at sea.[332]

The Barbados Sea Turtle Project (BSTP), operated through the University of the West Indies, has been active in publicizing the endangered status of turtles and the need to protect them. As so much of the coast is developed, the BSTP is working with hotels on the lighting problem. Barbados' large tourist industry encompasses many hotels. These facilities are often well lit and a large hotel can give off a great amount of light. This light can disorient the turtles, especially hatchlings. The BSTP is also encouraging the industry to promote ecotourism.[333]

Barbados' research on sea turtles has primarily focused on beach work on the nesting hawksbills. Some satellite tagging work to look at post-nesting migrations has been conducted. Research into the genetic structure, distribution, and abundance of hawksbill and green foraging populations is underway.[334]

An assessment of longline and other fishery interactions has not yet been seriously addressed in Barbados.[335] The impressive WIDECAST assessment of Barbados sea turtles, like much of the work in the

Caribbean, focuses on beach protection. The WIDECAST assessment contains little information turtle interactions with fisheries. It stress potential longline interactions, but provides no data on the extent of such interactions off Barbados.[336] WIDECAST simply advises, "It is widely known and intuitively obvious that enforcement is impractical, if not impossible, in the absence of public knowledge of and support for the law(s) being enforced."[337] This omission is understandable as the greatest priority of environmental organizations with limited resources has been to protect the vulnerable nesting sites--in itself a difficult undertaking. At sea protection is an even more complex undertaking. Environmentalists are, however, increasingly coming to the conclusion that years of effort protecting turtles ashore may be wasted if the reptiles are not protected at sea as well. Efforts are underway to assess fishery interactions with turtles in the Caribbean.[338]

Virtually no information on fishery interactions with turtles exists. The authors know of no Barbados research on the extent of fishery interactions with turtles.

Artisanal: The artisanal fleet mostly operates off the Barbados' western coast. This would seem to bring them in contact with hawksbills which mainly nest on the western and southern coasts--the most developed parts of the island. The artisanal fishery, however, is dominated by the flyingfish fishery and there would seem to be relatively limited likelihood of interactions with that fishery. As so much of the fishing industry is focussed on flyingfish, this may mean that interactions are relatively limited. More likely interactions in the past would appear to be fishermen spotting a turtle while fishing and capturing it.[339] This appears to have declined significantly since the new turtle moratorium was issued in 1998. A recreational fishermen reports that the Government "very strictly" enforces the ban on turtles.[340] Environmentalists are less convinced. They point out that there have been no convictions for poaching and question how strictly enforced the regulations are.[341]

Commercial: There is no shrimp trawling around Bermuda, a serious danger to turtles in other areas. Thus Barbados has not had to initiate a Turtle Excluder Device (TED) program.[342] Longline fishermen report not taking turtles.[343] One boat owner reports that a few turtles have been taken, but since the new regulations were passed in 1998, that they no longer land any.[344] No observer data exists on the longline fleet, however, to confirm these anecdotal reports from the fishermen. Interactions, if any, would be most likely off the eastern coast in the Atlantic where the longline fleet primarily operates. The association of hawksbills, the major nesting population, with coral reefs where they feed may limit interactions with longliners. Environmentalists, however, are very concerned over possible interactions with other species. Both leatherbacks and loggerheads are known to be taken on longlines. Observers on U.S. longliners operating in the Caribbean confirm that these are the species most affected by longlining (Caribbean Overview, appendix G5c). The loggerheads appear to be ingesting the baited hook while the leatherbacks most commonly become entangled in the lines.[345] Barbados turtle experts are particularly concerned about leatherbacks because of the nesting population on the island.[346] A few other reports from the Caribbean also document interactions.[347]

Recreational: Several recreational fishermen report observing turtles.[348] One fisherman reports an unusually large number of turtles in 1999. He reports that they are never taken by the recreational fishermen.[349]

F. Marine mammals

The authors have no information on longline interactions with marine mammals by Barbados fishermen. One recreational fisherman reports that 150 kilometers east of Barbados out into the Atlantic that the dolphins that often accompany boats along the coast are no longer seen.[350]

G. Seabirds

Many Barbadian fishermen, especially those targeting flyingfish, use the presence of seabirds to help them locate schools. While seabirds are present off Barbados, there are virtually no seabirds which actually nest on the island. One comprehensive 1984 report suggested that the only seabird that may nest on the island is *Puffinus l. lherminieri*. As a result the island has been classified by ornithologists as relatively unimportant as regards seabird nesting.[351] The reason that there are so few nesters is because Barbados is such a developed island, protected habitat simply does not exist. The authors have been unable to find any data on seabird reactions with fisheries. Local researchers know of no Barbados studies of fishery interactions with seabirds.[352]

XVI. International

A. International relations

1. Multilateral

Several multilateral agencies are involved in the Barbados fishing industry.

CARICOM: Barbados is an active participant in CARICOM. Barbados presented a strategy at CARICOM's eighth summit in 1987 for protecting the fishery resources of member states. Barbados suggested that CARICOM create a committee to draft a unified regional fisheries management program. Barbados was especially interested in reaching an arrangement with Trinidad and the Organization of Eastern Caribbean States (OECS) countries, which represent a relatively coherent geographic grouping.[353] Barbados participates in the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP).

ICCAT: Barbados is not currently a member of the International Commission for the Conservation of Atlantic Tunas (ICCAT), but has since the early 1990s expressed possible interest in membership.[354] Fishery officials indicated in 1998 that Barbados would either request contracting party status or full membership, but had not yet made the final decision.[355] The Barbados Cabinet decided in June 2000 to join the Commission.[356] Barbados will be the third Caribbean island country to join ICCAT.[357] Fishery officials have begun the process of acceding to the Convention and have contacted the ICCAT Secretariat to work out the details. Fishery officials are hopeful that the process can be completed before the end of 2000. The FD for years has collaborated with ICCAT programs. Barbadian officials support the objectives of ICCAT and its conservation program, but are concerned that the needs of the small Caribbean island countries are not being equitably addressed. Barbadian Minister of Agriculture and Rural Development, for example, has indicated to ICCAT that "The allocation of quotas based on historic catches without taking into account the social and economic importance of these fisheries, the relative sizes of the marine jurisdictions and the development stages of the countries seems particularly inequitable. This is especially so in light of recent international agreements which recognize the special case of developing states."[358] Fishery officials in 2000 were in the process of developing what they believe will be an appropriate catch allocation for Barbados. Similar positions have also been taken by larger South American fishing countries.[359] The Chief Fisheries Officer, Dr. Patrick McConney, believes that an appropriate allocation for Barbados should take into account the size of the Barbados EEZ and the potential resource available there.[360]

OECS: Barbados is not a member of the Organization of Eastern Caribbean States (OECS). Barbadian policy, however, has generally favored regional cooperation in management and enforcement. Some Barbados officials would like to see closer cooperation with, if not outright participation in, OECS. Barbadian Agriculture, Food, and Fisheries Minister David Bowen at a 1993 OECS Fisheries Enforcement and Prosecution Workshop held at the UWI Cave Hill campus stressed the need for increased regional cooperation on fisheries.[361] Barbados officials are interested in participating more fully in OECS, perhaps in some kind of special role such as an associate member. OECS has given some attention to fisheries. Projects underway such as a possible common fisheries zone could have a significant impact on Barbados.

2. Bilateral

Barbados has conducted bilateral fishery relations with several neighboring as well as distant-water countries.

Brazil: Barbados' principal distant-water fisheries relationship was with Brazil. Barbados shrimp trawlers fished on the Guianas Banks and northern Brazil during the 1960s and 1970s. Brazil declared a 200-mile fishing zone in 1971 and subsequently restricted foreign fishing within the zone.[362] Some Barbadian trawlers were reportedly seized. Barbados fishermen were allowed to operate briefly under 1973 and 1975 access agreements and a 1978 joint-venture arrangement, but the fishery ended when the access to Brazilian waters was terminated.[363]

Cuba: Barbados officials, as other Caribbean fishery officials, have noted no Cuban longline activity in the Caribbean.[364] There has been some limited fishing activity in the Atlantic southeast of Barbados (Cuba appendix C8f), but not off Barbados itself (appendix C3g). This is interesting because Cuba is the only Caribbean country with a longline fleet, but they deploy it off West Africa.

France: French officials met with Bahamian officials in 1980 to discuss assistance projects in fisheries and other areas. French officials explained that they provide about 35 percent of EU development funds, but they were also interested in possible bilateral projects.[365]

Guyana: Barbadian shrimp fishermen during the 1960s-70s fished extensively on the Guianas Banks. Barbados signed an access agreement with Guyana on August 29, 1978, permitting Barbados shrimp fishing in Guyana waters.[366]

Japan: Japanese fishery relations with Barbados are complicated by the overall bilateral relations. Japan has become a major supplier of motor vehicles, construction, equipment, electronic goods, and other items to Barbados. Many Barbadians objected to the one-sided trade relationship.[367] For several years, Barbadian officials have complained of alleged unlicensed Japanese fishing in Barbadian waters and of the Japanese making no real contribution to the development of the local fishing industry. Such complaints have been made at the highest official levels. Barbados Foreign Minister Henry Forde in 1978, for example, sharply criticized Japan for extensive fishing off Barbados and other Caribbean islands. Forde estimated that the Japanese harvested $100 million in fish and other marine products during a 5-year period.[368] Reacting to such criticism, the Japanese expanded a variety of assistance programs. The Japanese Government provided extensive loans ($85 million) to the Barbados Government from 1985-89. Barbadian officials have expressed an interest in technical assistance and increased purchases of Barbadian goods.[369] Japanese aid officials reportedly visited the country in 1988 to assess possible fishery development projects, but no details are available on the results. Japan has extensive foreign fishery assistance programs in the Caribbean, but the authors know of no Japanese projects on Barbados. Several Barbadian fishermen are critical of Japanese fishing off the country. Some have observed the Japanese discarding unwanted fish that the Barbadians would have retained.[370]

Korea: Barbadian officials have complained of alleged unlicensed Korean fishing in Barbadian waters and of the Koreans making no real contribution of the development of the local fishing industry.[371] Bilateral discussions have been held which have included fishery discussions.[372] The authors, however, know of no agreements reached on fisheries. Barbados has reportedly seized some Korean fishing vessels, but details are not available to the authors.

Martinique: Barbados officials reported a new 12-m Martinique longliner capable of rigging for multi-purpose fishing. Trials were reportedly conducted in 1999.[373]

Taiwan: Many Caribbean island countries during the 1980s recognized mainland China. Many of the smaller islands followed the lead of Barbados which recognized the mainland Government in 1976.[374] Taiwan officials have discussed possible fishery projects with Barbadian officials, including cold stores, wharves, and fishing centers.[375] One fishermen reports seeing Taiwan longliners within Barbados waters, fairly close to the coast during the early 1990s, but says he rarely sees them anymore, but they may be further offshore. The local Barbados fishermen used to cut or damage the lines when the opportunity presented itself.[376]

Trinidad: Barbados, Guyana, and Trinidad in 1975 agreed to a joint fisheries training and development program.[377] Barbados fishermen have reportedly fished extensively in Trinidadian waters, especially off Tobago. The primary target species is flyingfish, but other species including swordfish are reportedly also taken.[378] The Barbados fishermen did not purchase local licenses and as a result some were seized by the coastal countries off which they fished. Trinidad in particular acted to protect coastal fishing grounds and seized several small Barbadian fishing boats during the 1980s. The Barbadian fishermen were particularly affected by this lack of access to fishing grounds in Trinidadian waters.[379] Trinidadian officials seized two Barbadian boats in early 1989, fining the five fishermen $708 each and threatening confiscation of the boats if they were seized again in Trinidadian waters.[380] Barbadian fishermen insisted that the Government deny Trinidad fishermen the right to land and sell fish until Trinidadian officials provide the Bahamians access to fishing grounds. Barbadian fishermen organized a boycott of Trinidadian fish imports.[381] Several years of on-again, off-again negotiations followed.[382] Trinidad officials offered some limited access, but the initial offers in 1989 were rejected as inadequate by the Barbadian fishermen.[383] The two countries finally signed a 1-year "experimental" agreement on November 23, 1990 which was to cover 1991. The agreement allowed Trinidad fishermen (mostly from Tobago) to sell 300 t of whole and processed flyingfish and other associate pelagic species in Barbados. Trinidad in return granted access to 40 Barbadian fishing vessels, only one-third of which would be allowed to fish at any given time. License fees were set at $800 per boat. The agreement provides for Trinidadian observers.[384] The agreement was not renewed and after 1 year lapsed. Barbadian fishermen objected to the terms of the agreement which reported limited them primarily to flyingfish. Apparently operations were not economical unless the fishermen could retain other species as well. The Barbadian fishermen also complained about the allegedly high cost of the licenses. Barbadian officials in 1995 reportedly held preliminary discussions with their Trinidadian counterparts about the possibility of future access.

United States: The United States began developing a longline fleet targeting yellowfin tuna in the Gulf of Mexico. Beginning in the mid-1980s, U.S. longline fishermen began targeting swordfish after commercial stocks were encountered off the Florida Atlantic coast.[385] A small number of the swordfish/tuna U.S. longliners are active in the wider-Caribbean, including grounds to the north and east of Puerto Rico.U.S.

longliners reportedly began operating off Barbados during the 1980s.[386] One U.S. fishermen during the mid-1980s reportedly operated two longliners, the *Millertime* and the *Millertime II* out of Barbados and Grenada. The owner did not obtain Barbadian licenses, indicating that his vessels fished outside the Barbados 200-mile EEZ. The owner was reportedly studying the investment in onshore processing facilities. He did attempt to obtain Grenadian licenses. (See: "Grenada.") Many Barbadian fishermen and others associated with the fishery are critical of the U.S. and other foreign fishing in the Caribbean area, claiming it is adversely affecting stocks and resulting in lower Barbadian catches.[387] Data available on U.S. operations show little fishing immediately around Barbados, but some fishing further out in to the Atlantic.[388]

Venezuela: Barbados has reportedly seized some Venezuelan fishing vessels, but details are not available to the authors.

B. Joint ventures

Grenadian companies have formed few joint ventures with foreign companies. The only such ventures known to the authors were involved in the shrimp fishery during the 1960s-70s.

Brazil: Barbados and Brazilian companies in the 1970s formed joint shrimp ventures allowing access to Brazilian grounds.[389]

Trinidad: The Trinidad and Barbadian Governments formed a joint shrimp company in 1976.[390]

United States: The U.S. owned company, the Barbados Seafood Company, was active during the 1960s exporting mostly shrimp to the United States.[391] Some joint ventures were reportedly formed with individual U.S. fishermen operating swordfish longliners during the late 1980s. The U.S. fishermen who had begun longlining operations in the Western Atlantic and eastern Caribbean were looking for a local port from which they could operate. These ventures did not prove successful and were discontinued.

C. Foreign aid

The relatively high income levels on Barbados have meant that the country has not been a high priority for foreign donor agencies. The FAO and European Union have been the primary sources of foreign assistance to the fishing industry.

Canada: Canada provided technical assistance to the IDB fisheries development project during the 1970s. McGill University prepared an economic study of the fishing industry.[392] The Canadian International Development Agency (CIDA) announced a project to help modernize vessels, gear, and fishing methods.[393] Canadian officials reportedly visited the country in 1988 to assess possible fishery development projects.

Caribbean Development Facility: The Caribbean Development Facility (CDF) helped finance the Oistins fisheries complex during the early 1980s. Funds contributed by the U.S. Agency for International Development (AID) helped financed the Oistins reclamation and fisheries project.[394]

Caribbean Development Bank (DDB): The Caribbean Development Bank helped administers CDF funds and has funded some fishery projects, including part of the Oistins port project.[395]

European Union: The European Union (EU) European Development Fund (EDF) focused on improving ports and marketing facilities. EU assistance was initiated in 1975 and work on ports has continued through 1999.[396] The largest project financed the $1 million fisheries complex which opened in 1983.[397] EU officials consider the Oistins project to be one of their most successful Caribbean projects.[398]

Photo 61.--The European Union has helped finance the construction of a modern new fishing port at Conset Bay for the artisanal fishermen. Dennis Weidner

Barbados fishermen working the southern coast. The EU also help fund a jetty and market at Speightstown. The EDF in 1988 initiated a $3 million to improve Speightstown and some of the small landing sites along the eastern coast.[399] Construction at two eastern ports was underway in 1999.

FAO: The UNDP/FAO sponsored the Caribbean Fisheries Development Project during the 1960s-70s.[400] Barbados beginning in 1974 participated in the UNDP/FAO Caribbean Fisheries Training and Development Project which followed up on the Caribbean Fisheries Development Project. The FAO Investment Centre in 1982 funded a private consultant (Fisheries Development Ltd.) to prepare a marine fisheries project.

IDB: The Inter-American Development Bank (IDB) in 1975 approved a $3.6 million loan to help fund a coastal zone management program in Barbados.[401] The IDB also approved a $3.1 million loan for a fishery project involving Canadian technical assistance and a $0.4 million grant for institutional support.[402] The IDB approved a $8.0 million project in 1984 to build a modern new fisheries port at Bridgetown. The Bridgetown fishing port opened in 1988.[403] It quickly became the center of the island's fishing industry. The IDB approved a $6 million project in 1985 to provide credit for various projects including fisheries.[404]

Taiwan: Taiwan stationed a fisheries expert on Barbados for 2 years in the 1970s.[405]

United States: The United States has help to finance CDB loans.[406] Of more importance than governmental aid, has probably been informal contacts by which Barbados fishermen have acquired U.S. fishing equipment and learned about the monofilament longlining methods developed by the U.S. fishermen.

XVII. Enforcement

Barbados does not have a monitoring, control, and surveillance (MCS) program for fisheries enforcement and management. The only monitoring of the EEZ is conducted during the regular coastal surveillance by the Coast Guard unit of the Barbados Defense Force (BDF). The British Government has provided some aid to the BDF and the Royal Navy in initiating a fisheries protection service.[407] The BDF acquired the *Trident*, a 37-m fast patrol boat from the United Kingdom in 1982. One 1982 report indicated the BDF Coast Guard consisted of the *Trident*, *Enterprise* and *Excellence* (converted 22-m shrimp trawlers), *George Fergusson* (a 20-m fast patrol boat), and *J.T.C. Ramsey* (a 12-m boat).[408] BDF patrol craft like the *Trident* have conducted joint operations with patrol craft from other OECS countries.[409] The Regional Security System has recently agreed to include fisheries monitoring as part of drug interdiction and surveillance activities. Barbados is interested in a MCS program, but has not yet begun to assess the technologies required.[410] Fishery officials are also interested in vessel monitoring system (VMS), perhaps as a larger regional arrangement.[411]

Photo 62.--Barbados has a small, but well trained Coast Guard. Their largest ship is the fast patrol boat "Trident". D. Weidner

XVIII. Future Trends

Barbados fishermen deploy one of the largest commercial pelagic longline fleets of the Caribbean island countries. Cuba had a larger fleet, but did not extensively operate its longliners in the Caribbean. Grenada still has a larger fleet, but many vessels are small artisanal craft. The overall Barbados fishery was mostly conducted by day-boats and ice-boats which intensely fished available coastal resources. The introduction of longliners in the late 1980s significantly expanded local fishing operations, allowing the island's fishermen to target lightly utilized offshore resources and to widen the seasonality of the fishery.

The Barbados longline fishery grew out of experimental fishing by the country's ice boat fishermen who began experimenting with small longlines. Several vessels were modified for longlining in the 1990s and the Barbados fleet in 1999 total about 30, reactively small boats. The Fisheries Division considered the pelagic longline fleet to be one of the most promising sectors of the Barbados fishing industry. Optimism in the industry, however, has cooled considerably. Efforts in the mid-1990s to introduce large commercial longliners proved unsuccessful. The Barbadian fleet usually operates within the country's 200-mile EEZ, in part because of the limited range of the small boats. Barbadian fishermen only report a small swordfish catch. Much of the Barbadian fleet focuses on tuna. U.S. imports of tuna and swordfish peaked in 1995-97 at $2.3-2.4 million, despite the addition of new vessels. Actual shipments were actually less as this amount included transshipments by U.S. longliners.

The fleet has mostly developed locally. A few U.S. captains have been contracted, but operations have primarily been conducted by Barbadian captains. A small number of U.S. longliners occasionally land their catch in Barbados, for transhipment to the United States. There is no evidence of any significant involvement by foreign longliners in the near future.

Some additional artisanal fishermen and investors are still interested in entering the longline fishery. The mixed results achieved by the current longline fishermen, have introduced some caution in their plans. The acquisition of new boats appears to have come to an at least temporary standstill. Yields tend to be relatively low. None of the operations appear to be returning high profits, or at least the kind of profits that investors had anticipated. Some of the fishermen do report better results than those focusing on more costal resources. Other fishermen report operations in which they have lost money. Some have ceased operations. Investors who often are not the vessel captains face constraints in introducing new technology needed to make their vessels more efficient. As a result, while a few new longliners may be added to the fleet in the next few years, any major expansion is unlikely.

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17. Robin Mahon, Justin Rennie, Raymond Ryan, and Susan Sing-Renton, "Billfish catch and effort data from Barbados, Grenada, St. Lucia and St. Vincent and the Grenadines," *ICCAT Collective Volume of Scientific Papers* (SCRS/92/68), XLI (ICCAT: Madrid, 1994), pp. 433-435.
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19. W. Hunte, H. Oxenford, P. McConney, and G. Dharmarante, "The feasibility of developing longline fisheries in Barbados," *Barbados Development Bank Technical Report*, (Bridgetown: Barbados Development Bank, 1993), p. 30.
20. See the Brazilian chapter of this report for details on the INO and other genetic research.
21. Burt Ely, Department of Biological Sciences, University of South Carolina, personal communications, March 24, 2000 and Ault, *op. cit.*, March 30, 2000.

22. W. Hunte, H. Oxenford, P. McConney, and G. Dharmarante, "The feasibility of developing longline fisheries in Barbados," *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 66.

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26. W.D. Wilson and W.E. Johns, "Velocity structure and transport in the Windward Island passages," *Deep Sea Research*, Part I, Vol. 44, no. 3, April, 1997, pp. 487-520.
27. J. Marcille, "Tuna resources of the Lesser Antilles: Present state of fishing and prospects for development," *FAO Fisheries Circular*, No. 787 (Firm/c787) (FAO: Rome, August 1985), pp. 3-5.
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30. Winston Giddings, Boat Inspector, Fisheries Division, personal communications, September 21, 1999.
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32. Robert Hastings, "Barbados learns that fish can be better on ice," *Fishing News International*, July, 1984, p.78 and David Messiah, "The fishing fleet of Barbados," *World Fishing*, December 1987, pp. 39-40.
33. McConney, *op. cit.*, June 9, 2000.
34. Cramer, "Large pelagic logbook ...," *op. cit.*
35. A list of charter boat operators is available from the Barbados Game Fishing Association, "Barbados Game Fishing Operators," at: http://barbados.org/fishing.htm, retrieved April 12, 1999.
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38. Available sources vary somewhat on vessel characteristics. FAO, "Barbados," *Fishery Country Profiles* (FAO: Rome, November, 1984), p. 2; Hastings, "Barbados ...," *op. cit.*, p. 79; "Changing with the times," *Sun Shine*, February 28, 1988, p. 13; Ralph V. Jones, "The small-scale fisheries credit programme in Barbados," in "Fisheries credit programmes and revolving loan funds: Case studies," U. Tietze and P. Merrikin, eds., *FAO Fisheries Technical Paper*, No. 312 (FAO: Rome, 1989), p. 78; U.S. Embassy, Bridgetown, "Conservation of sea turtles: Barbados," message number 755, January 31, 1990; and Messiah, "The fishing fleet ...," *op. cit.*, p. 40.
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40. The relative economics of dayboats and iceboats are discussed in W. Hunte and H.A. Oxenford, "The economics of boat size in the Barbados pelagic fishery," *Gulf and Caribbean Fisheries Institute Proceedings, 1986*, no. 39, 1989, pp. 230-239.
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49. Norman Faria, "US giving Barbadian fishermen a raw deal," *Barbados Advocate*, April 21, 1988.
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51. McConney, *op. cit.*, June 9, 2000.
52. U.S. Embassy, Bridgetown, "Economic survey: Barbados, 1965," message number A-96, April 27, 1966.

53. Faria, "US giving ...," *op. cit.*
54. Marshall, *op. cit.*, September 23, 1999.
55. Norman Faria, "US giving Barbadian fishermen a raw deal," *Barbados Advocate*, April 21, 1988.
56. Stephen Willoughby, "Operations of U.S. longliners in Barbados, Vol. I," in Hunte, Oxenford, McConney, and Dharmarante, Hunte, W., H. Oxenford, P. McConney, and G. Dharmarante. "The feasibility of developing longline fisheries in Barbados," *Barbados Development Bank Technical Report*, (Bridgetown: Barbados Development Bank, 1993), p. 4 and Crown Agents. "Institutional strengthening of the Fisheries Division of the Ministry of Agriculture, Food, and Fisheries, Barbados," in W. Hunte, H. P. Oxenford, and G. McConney, and G. Dharmarante, "The feasibility of developing longline fisheries in Barbados," *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p 11.
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63. Ministry of Economic Affairs, "Fisheries," *Barbados Economic Report*, 1993 (MEA: Bridgetown, March, 1994).
64. Mike Christian, NMFS, personal communications, February 15, 1994.
65. See the Brazilian chapter for details on the leasing of foreign longliners.
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67. Timothy Simmons, Margrace 1, owner, personal communications, September 23, 2000.
68. Hazel Oxenford, University of the West Indies, personal communications, June 4, 1999.
69. Anthony Stout, General Manager, Fish of Barbados, personal communications, May 8, 2000.
70. McConney, *op. cit.*, June 9, 2000.
71. "Barbados goes lining ...," *op. cit.*, p. 52.
72. "Barbados goes lining ...," *op. cit.*, p. 52.
73. ICCAT, *Quarterly Highlights Report*, January-March, 1981.
74. T. Simmons, *op. cit.*, September 23, 2000.
75. McConney, *op. cit.*, June 9, 2000.
76. McConney, *op. cit.*, June 9, 2000.
77. Stephen Roach, Cannon Charters, personal communications, June 8, 1999; Steven Burke, personal communications, June 8, 1999; David Marshall, President, Barbados Game Fishing Association, personal communications, June 9, 1999; Bunny Best, personal communications, June, 16, 1999; Brek Bailey, Blue Marlin Charters, personal communications, June 16, 1999.
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98. A good, but now dated assessment of the dorado fishery is available in Oxenford and Hunte, "Long-term trends ...," *op. cit.*, pp. 510-527.
99. Hastings, "Barbados ...," *op. cit.*, p. 78.
100. Gomez, *op. cit.*, March 28, 2000.
101. FAO, "Barbados," *op. cit.*, p.2.
102. Burke, *op. cit.*, June 8, 1999.
103. Jones, "The small-scale fishermen ...," *op. cit.*, p. 78.
104. Gomez, *op. cit.*, March 28, 2000.
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107. Roach, *op. cit.*, June 9, 1999.
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109. Simmons, *op. cit.*, September 23, 2000.
110. McConney, *op. cit.*, June 9, 2000.
111. Stout, *op. cit.*, May 8, 2000.
112. Hunte, Oxenford, McConney, and Dharmarante, "The feasibility ...," *op. cit.*, p. 68.
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115. James Bardon, Bridgetown Fishing Port, personal communications, September 22, 1999.
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123. Dr. Hazel Oxenford, University of the West Indies, personal communications, June 4, 1999.
124. Bailey, *op. cit.*, June 16, 1999.
125. McConney, *op. cit.*, June 9, 2000.
126. T. Simmons, *op. cit.*, September 23, 1999.
127. T. Simmons, *op. cit.*, September 23, 1999.
128. Hunte, Oxenford, McConney, and Dharmarante, "The feasibility ...," , *op. cit.*, pp. 155-172.
129. McConney, *op. cit.*, June 9, 2000.
130. Marshal, *op. cit.*, September 23, 1999.
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132. Bailey, *op. cit.*, June 16, 1999.
133. Roach, *op. cit.*, June 8, 1999 and Bailey, *op. cit.*, June 16, 1999.
134. McConney, *op. cit.*, June 9, 2000.
135. Burke, *op. cit.*, June 8, 1999; Marshall, *op. cit.*, June 9, 1999; and Best *op. cit.*, June 16, 1999.
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137. Roach, *op. cit.*, June 9, 1999.
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142. Marshall, *op. cit.*, September 23, 2000.
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144. ICCAT, "Bi-annual highlights report," 1-7,1995, *op. cit.*, p. 2.
145. Roach, *op. cit.*, June 8, 1999, and Marshall, *op. cit.*, August 8, 2000.
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148. Marshall, *op. cit.*, August 8, 2000.
149. Best, *op. cit.*, June 16, 1999 and Bailey, *op. cit.*, June 16, 1999.
150. Marshall, *op. cit.*, August 8, 2000.
151. Roach, *op. cit.*, June 8, 1999; Burke, *op. cit.*, June 8, 1999; Best, *op. cit.*, June 16, 1999; Marshall, *op. cit.*, August 8, 2000.
152. Marshall, *op. cit.*, June 9, 1999 and Best, *op. cit.*, June 16, 1999.
153. Marshal, *op. cit.*, September 23, 2000.
154. Bailey, *op. cit.*, June 16, 1999.
155. Roach, *op. cit.*, June 8, 1999.
156. Burke, *op. cit.*, June 8, 1999.
157. Marshall, *op. cit.*, September 23, 2000.

SECTION VII. (Catch)

158. The authors generally use the data published by FAO as its the most comprehensive data set for the longest time frame (appendix C3). FAO does not list swordfish as separate category. The FAO data is supplied by the FD. The authors are unsure why some ICCAT data varies with the FD (appendix C3), as the FD is also ICCAT's primary source. Swordfish catches for much of this period have been very small. In the last few years (1984-99), the authors have used data received directly from the FD for swordfish trends (appendix B7e).
159. The tourist trade provides a domestic market for swordfish. Any significant landings would almost certainly mean that some swordfish would be shipped to the United States. The domestic catch when no exports to the U.S. occur can thus assume to have been quite small.
160. Anthony Stout, General Manager, Fish of Barbados, personal communications, May 8, 2000.
161. Juhl, *op. cit.*, March 25, 1988.
162. S. Willoughby, "Operations of U.S. longliners in Barbados, Vol. I," in Hunte, Oxenford, McConney, and Dharmarante, *The Feasibility ...*, *op. cit.*, pp. 4-5 and 65.
163. R. Mahon, F. Murphy, P. Murray, J. Rennie, and S. Willoughby, "Temporal variability of catch and effort in pelagic fisheries in Barbados, Grenada, St. Lucia, and St. Vincent: With particular reference to the problem of low catches in 1989," *FAO Field Document*, (FI/TCP/RLA/8963), no. 2, 74p.
164. S. Willoughby, "Operations of U.S. longliners in Barbados, Vol. II," in Hunte, Oxenford, McConney, and Dharmarante, *The Feasibility ...*, *op. cit.*, pp. 5-7.
165. The tourist trade provides a domestic market for swordfish. Any significant landings would almost certainly mean that some swordfish would be shipped to the United States. The domestic catch when no exports to the U.S. occur can thus assume to have been quite small.
166. Hunte, Oxenford, McConney, and Dharmarante, *The Feasibility ...*, *op. cit.*, p.1.
167. Care should be taken in using Barbados statistics. The DF usually reports landings which in the case of swordfish is trunks (logs). To convert to catch as reported by FAO and ICCAT, the live-weight must be calculated. The authors have calculated the trunk as about 70 percent of the fish's live weight.
168. CFRAMP, "Report of the CARICOM ...," (SCRS/98/102), p. 2.
169. Marshall, *op. cit.*, June 9, 1999.

170. Roach, *op. cit.*, June 8, 1999.

SECTION VIII. (Ports)

171. Fisheries Division, *Barbados Fisheries Management Plan*, *op. cit.*, pp. 2-2-3.
172. Barbados Port Authority, "Barbados: Port of the year," http://barbadosport.com/pages/barbados.htm, accessed April 12, 1999.
173. U.S. Embassy, Bridgetown, "Barbados begins study of fishing harbor project," message number 1745, April 9, 1980.
174. "Aid for Barbados," *World Fishing*, August, 1985, p. 59 and "Barbados: Nuevo puerto pesquero en 1988," *Chile Pesquero*, March-April, 1988, p. 15.
175. "Barbados: New harbor for next year," *The IDB*, December, 1987, p. 5.
176. Dennis Weidner, "Barbados to build fishing port," *International Fisheries Report* (IFR-84/71), October 10, 1984.
177. McConney, *op. cit.*, September 21, 2000.
178. McConney, *op. cit.*, June 19, 2000.
179. Roach, *op. cit.*, June 8, 1999.
180. EDF, "Operational summary: ACP states," *Courier*, No. 65, January-February, 1981.
181. "Ultramodern fishing facility at Oistins set to open soon," *Advocate News*, April 6, 1983, p. 8 and "EEC-Barbados Cooperation," *The Courier*, September-October, 1984, p. 35.
182. Hastings, "Barbados ...," *op. cit.*, p. 79.
183. FAO, "Barbados," *op. cit.*, pp.2-3.
184. Roach, *op. cit.*, June 8, 1999.
185. "Government seeks foreign aid to modernize fishing industry," *Advocate News*, November 11, 1982, p. 1.
186. EDF, "Operational summary: ACP," *The Courier*, September-October, 1985.

SECTION IX. (Transshipments)

187. Robin Mahon, consultant, personal communications, December 1, 1995.
188. Rawle C. Eastmond, M.P., Minister for Agriculture and Rural Development, communications with ICCAT, October 16, 1998.
189. McConney, *op. cit.*, June 9, 2000.
190. For details see the chapters on Puerto Rico and the U.S. Virgin Islands.
191. Andy Bertolino, NMFS, personal communications, May 9, 2000.
192. Dr. McConney hopes to complete his investigation during July 1999. Patrick McConney, Chief Fisheries Officer, personal communications, May 12, 1999.

SECTION X. (Processing and Products)

193. CARICOM, "Fishing industry profile ...," *op. cit.*
194. Crown Agents, "Institutional strengthening of the Fisheries Division of the Ministry of Agriculture, Food, and Fisheries, Barbados," in W. Hunte, H. P. Oxenford, and G. McConney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados," *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 11.

SECTION XI. (Companies)

195. U.S. Embassy, Bridgetown, "Economic survey: Barbados, 1966," message number A-123, April 25, 1967. Details on Barbados Seafood Limited are available in U.S. Embassy, Bridgetown, "US flag shrimp fishing and Brazil's 200-mile decree," message number 220, April 3, 1970.
196. U.S. Embassy, Bridgetown, "Barbados and Brazil sign shrimp agreement," message number A-125, July 18, 1973; Faria, "Fishing problems," *op. cit.*, p. 10; and "New plan in shrimping," *Sunday Advocate News*, May 21, 1978.
197. Roach, *op. cit.*, June 8, 1999.
198. "Barbados goes lining with bigger boats," *Fishing News International*, November, 1993. p. 52.
199. Anthony Stout, General Manager, Fish of Barbados, personal communications, May 8, 2000.

200. Stout, *op. cit.*, June 29, 2000.
201. Kyle Harris, Morgan's Fish House, personal communications, September 23, 1999.
202. David Sumpter, General Manager, Ocean Fisheries, personal communications, May 12, 2000.
203. Timothy Simmons, *op. cit.*, September 24, 1999.
204. Several Caribbean companies currently involved with exporting seafood to the United States have expressed an interest in exporting to Europe, in part because of complications accessing the U.S. market. The general experience, however, after assessing the possibility is that European markets are more difficult to enter than the nearby United States.
205. Sumpter, *op. cit.*, May 12, 2000.
206. Trevor Simmons, *op. cit.*, May 12, 2000.
207. Timothy Simmons, *op. cit.*, September 23, 1999.
208. Trevor Simmons, *op. cit.*, May 12, 2000.

SECTION XII. (Markets)

209. Crown agents, "Institutional strengthening ...," *op. cit.*, p. 11. Part of the objection to frozen fish is the very poor quality frozen product that was available.
210. Hastings, "Barbados ...," *op. cit.*, p. 79.
211. A good recent description of the fishery and market is available in Melhuish, "Barbados: Flying fish paradise," *op. cit.*, pp. 10-11.
212. Crown Agents, "Institutional strengthening ..., " *op. cit.*, p. 14.
213. Fisheries Division, *Barbados Fisheries Management Plan*, *op. cit.*, p. 2-2.
214. Jones, "The small-scale fisheries ...," *op. cit.*, p. 88.
215. FAO, "Barbados," *op. cit.*, p. 3.
216. Roach, *op. cit.*, June 8, 1999.
217. Stout, *op. cit.*, May 8, 2000.
218. Hunte, Oxenford, McConney, and Dharmarante, "The feasibility ...," *op. cit.*, p. 104.
219. Sumpter, *op. cit.*, May 12, 2000.
220. Stout, *op. cit.*, May 8, 2000.
221. Sumpter, *op. cit.*, May 12, 2000.
222. Hunte, Oxenford, McConney, and Dharmarante, "The feasibility ...," *op. cit.*, p. 112.
223. Harris, *op. cit.*, September 23, 2000.
224. Hunte, Oxenford, McConney, and Dharmarante, "The feasibility ...," *op. cit.*, pp. 112-113.
225. Stout, *op. cit.*, May 8, 2000.
226. Sumpter, *op. cit.*, May 12, 2000.
227. McConney, *op. cit.*, June 9, 2000.
228. McConney, *op. cit.*, June 9, 2000.
229. Hunte, Oxenford, McConney, and Dharmarante, "The feasibility ...," *op. cit.*, appendix 6.
230. Sumpter, *op. cit.*, May 12, 2000.
231. Roach, *op. cit.*, June 8, 1999 and Bailey, *op. cit.*, June 16, 1999.
232. Mahon, *op. cit.*, February 23, 1996 and Hunte, Oxenford, McConney, and Dharmarante, "The feasibility ...," *op. cit.*, pp. 95-113.
233. Import data corrected by the level of recorded U.S. transshipments significantly lower the quantity of swordfish being imported from Barbados (appendix C3a2).
234. *Barbados Advocate*, April 21, 1988.
235. U.S. Embassy, Bridgetown, "Barbados: Controversy over swordfish," message number 3507, April 22, 1988.
236. Sources with an established history are also tested, but they are not automatically detained pending completion of the testing. U.S. Department of State, "Swordfish contamination," message number 138457, April 30, 1988.
237. Several fishing companies (both foreign and domestic) are exempt from automatic detention if they have a consistent record of catching untainted swordfish. Such an exemption is granted through an application process. U.S. Department of Commerce, "U.S. imports of swordfish," message number 8402, June 21, 1988.
238. Eastmond, *op. cit.*, October 16, 1998.
239. McConney, *op. cit.*, June 9, 2000.
240. McConney, *op. cit.*, June 9, 2000.
241. Available information on these facilities is included in the St. Maarten and Trinidad chapters of this report.
242. McConney, *op. cit.*, June 9, 2000.

243. Harris, *op. cit.*, September 23, 1999 and McConney, *op. cit.*, June 19, 2000.
244. McConney, *op. cit.*, June 9, 2000.

SECTION XIII. (Government Policy)

245. "Barbados to introducing new fisheries legislation," *Network News*, September, 1990, p. 7.
246. "Act urgently on protection," *Fishing News International*, November, 1993, p. 5.
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APPENDICES

Series A: Fleet
Series B: Fleet Operations
Series C: Catch
Series D: Price
Series E: Trade
Series F: Sport Fishing
Series G: Glossary
Series H: Management Plan

Appendix A1.--Barbados. Fishing fleet, 1983-95

Vessel type	Year												
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
	Number												
Artisanal													
Moses/dories*	200	200	200	177	225	250					190		
Launches*	390	400	400	442	450	450					255		
	590	600	600	619	675	700					445		
Commercial													
Iceboats	20	37	51	61	70	80					68		
Longliners	-	-	-	-	-	-					6		18E
Total	610	637	651	680	745	780					519		

E - Estimated from unofficial sources.
* Day boats.
Sources: Economic Planning Unit, Ministry of Agriculture, Food and Fisheries (1983-88 and 1993 data). Various other sources.

Appendix A2a.--Barbados. Longline fleet, September, 1999

Vessel	Owner	Size			Hold	Hull	Acquired**	Built		Details
		Length	Width	Draft				Country	Year	
			Meters		Tons					
Against the Odds		14.9	4.0	1.6		Wood	1996			
Blue Runner		NA	NA	NA		NA	NA			Rarely deployed
Aliva III		14.0	4.5	1.2		GRP	1993			
Carol-Ann		13.7	5.2	1.8		GRP	1999			
Challenger		12.2	3.7	1.2		GRP	1987			
Colleen Cheramie	Fins & Fathoms	27.4	7.0	2.7	25*	Steel	1993	U.S.	1973	Converted oil crew boat, Sunk
Commander		19.8	5.5	1.8		Steel	1996			
Cygnus Ranger		11.6	4.3	1.8		GRP	1982			
Danielle Amand		14.8	4.0	1.5		Wood	1992			
Destiny		15.2	4.9	2.4		Steel	1992			
Emily Ann		15.0	6.7	1.8		GRP	1999			
Endeavour		14.0	4.6	1.5		GRP	1993			
Gricel-S		15.1	5.0	1.5		GRP	1996			
Heidsue		12.0	3.9	1.2		GRP	1991			
JUMA IV		12.3	4.1	1.9		GRP	1996			
Jambar		13.4	4.3	1.5		GRP	1999			
Joan J		17.4	5.8	1.7		GRP	1997			
Kams		14.6	4.1	1.4		Wood	1996			
King of Kings	Fins & Fathoms	24.4	7.3	3.4	50	Steel	1993	U.S.	1973	Converted shrimp trawler, Inactive.
Lady Di										Active-early 1990s; Withdrawn from fleet.
Lucky Lady		11.6	4.0	1.2		GRP	1995			
Mar Grace #1	Simmons brothers	21.3	6.0	2.7		GRP	1997			
Mark I		12.2	3.7	1.2		GRP	1993			
Neptune Goddess		22.9	7.0	3.4		Steel	1992			
Oriana		12.8	4.0	1.2		Wood	1991			
Run-away		12.2	3.7	1.2		GRP	1970			
Sea Breeze		13.4	4.9	1.2		GRP	1988			
Sea Sprite		18.9	7.3	1.8		GRP	1996			
Sihor III		13.7	3.8	1.3		Wood	1991			
Sugar 'n Spice		12.8	3.7	1.2		GRP/Wood	1986			
The Triumph		17.0	4.8	1.5		GRP	1993			
Zelwood II		13.9	3.8	1.4		Wood	1993			

GRP-Glass reinforced plastic or fiberglass.
* 15 t of chilled fish and 10 t of frozen fish.
** Date registered in Barbados. Several of these vessels were registered and used in other fisheries before being converted for longlining.
Source: Fisheries Division, computer printout, September 21, 1999, and various other sources.

Appendix A2b.--Barbados. Longline fleet, by year of registry, September, 1999

Year# vessel	Owner	Size Length	Size Width	Size Draft	Hold	Hull	Acquired**	Built Country	Built Year	Details
		Meters			Tons					
1970										
Run-away		12.2	3.7	1.2		GRP	1970			
1982										
Cygnus Ranger		11.6	4.3	1.8		GRP	1982			
1986										
Sugar 'n Spice		12.8	3.7	1.2		GRP/Wood	1986			
1987										
Challenger		12.2	3.7	1.2		GRP	1987			
1988										
Sea Breeze		13.4	4.9	1.2		GRP	1988			
1991										
Heidsue		12.0	3.9	1.2		GRP	1991			
Oriana		12.8	4.0	1.2		Wood	1991			
Sihor III		13.7	3.8	1.3		Wood	1991			
1992										
Danielle Amand		14.8	4.0	1.5		Wood	1992			
Destiny		15.2	4.9	2.4		Steel	1992			
Neptune Goddess		22.9	7.0	3.4		Steel	1992			
1993										
Aliva III		14.0	4.5	1.2		GRP	1993			
Colleen Cheramie	Fins & Fathoms	27.4	7.0	2.7	25*	Steel	1993	U.S.	1973	Converted oil crew boat, Sunk.
Endeavour		14.0	4.6	1.5		GRP	1993			
King of Kings	Fins & Fathoms	24.4	7.3	3.4	50	Steel	1993	U.S.	1973	Converted shrimp trawler, Inactive.
Mark I		12.2	3.7	1.2		GRP	1993			
The Triumph		17.0	4.8	1.5		GRP	1993			
Zelwood II		13.9	3.8	1.4		Wood	1993			
1995										
Lucky Lady		11.6	4.0	1.2		GRP	1995			
1996										
Against the Odds		14.9	4.0	1.6		Wood	1996			
Commander		19.8	5.5	1.8		Steel	1996			
Gricel-S		15.1	5.0	1.5		GRP	1996			
JUMA IV		12.3	4.1	1.9		GRP	1996			
Kams		14.6	4.1	1.4		Wood	1996			
Sea Sprite		18.9	7.3	1.8		GRP	1996			
1997										
Joan J		17.4	5.8	1.7		GRP	1997			
Mar Grace #1	Simmons brothers	21.3	6.0	2.7		GRP	1997			
1999										
Carol-Ann		13.7	5.2	1.8		GRP	1999			
Emily Ann		15.0	6.7	1.8		GRP	1999			
Jambar		13.4	4.3	1.5		GRP	1999			
Unknown										
Lady Di										Active-early 1990s; Withdrawn from fleet.

GRP-Glass reinforced plastic or fiberglass.
The year appears to the registration date. Some of these vessels may not have been longliners when first registered.
* 15 t of chilled fish and 10 t of frozen fish.
** Date registered in Barbados. Several of these vessels were registered and used in other fisheries before being converted for longlining.
Source: Fisheries Division, computer printout, September 21, 1999 and various other sources.

Appendix A2c--Barbados. Longline fleet, by size length, September, 1999

Vessel	Owner	Size			Hold	Hull	Acquired**	Built		Details
		Length	Width	Draft				Country	Year	
			Meters		Tons					
Colleen Cheramie	Fins & Fathoms	27.4	7.0	2.7	25*	Steel	1993	U.S.	1973	Converted oil crew boat, Sunk.
King of Kings	Fins & Fathoms	24.4	7.3	3.4	50	Steel	1993	U.S.	1973	Converted shrimp trawler, Inactive.
Neptune Goddess		22.9	7.0	3.4		Steel	1992			
Mar Grace #1	Simmons brothers	21.3	6.0	2.7		GRP	1997			
Commander		19.8	5.5	1.8		Steel	1996			
Sea Sprite		18.9	7.3	1.8		GRP	1996			
Joan J		17.4	5.8	1.7		GRP	1997			
The Triumph		17.0	4.8	1.5		GRP	1993			
Destiny		15.2	4.9	2.4		Steel	1992			
Gricel-S		15.1	5.0	1.5		GRP	1996			
Emily Ann		15.0	6.7	1.8		GRP	1999			
Against the Odds		14.9	4.0	1.6		Wood	1996			
Danielle Amand		14.8	4.0	1.5		Wood	1992			
Kams		14.6	4.1	1.4		Wood	1996			
Endeavour		14.0	4.6	1.5		GRP	1993			
Aliva III		14.0	4.5	1.2		GRP	1993			
Zelwood II		13.9	3.8	1.4		Wood	1993			
Carol-Ann		13.7	5.2	1.8		GRP	1999			
Sihor III		13.7	3.8	1.3		Wood	1991			
Jambar		13.4	4.3	1.5		GRP	1999			
Sea Breeze		13.4	4.9	1.2		GRP	1988			
Oriana		12.8	4.0	1.2		Wood	1991			
Sugar 'n Spice		12.8	3.7	1.2		GRP/Wood	1986			
JUMA IV		12.3	4.1	1.9		GRP	1996			
Run-away		12.2	3.7	1.2		GRP	1970			
Challenger		12.2	3.7	1.2		GRP	1987			
Mark I		12.2	3.7	1.2		GRP	1993			
Heidsue		12.0	3.9	1.2		GRP	1991			
Cygnus Ranger		11.6	4.3	1.8		GRP	1982			
Lucky Lady		11.6	4.0	1.2		GRP	1995			
Lady Di		NA	NA	NA						Active-early 1990s; Withdrawn from fleet.

GRP-Glass reinforced plastic or fiberglass.
NA - Not available.
* 15 t of chilled fish and 10 t of frozen fish.
** Date registered in Barbados. Several of these vessels were registered and used in other fisheries before being converted for longlining.
Source: Fisheries Division, computer printout, September 21, 1999 and various other sources.

Appendix A3.--Barbados. Longline fleet, 1990-97

Year	Longliners
	Number
1990	NA
1991	NA
1992	NA
1993	NA
1994	NA
1995	NA
1996	NA
1997	NA

NA - Not available (ICCAT does not list Barbadian vessels in its fleet section).
Source: ICCAT, *Yearbook of Fishery Statistics*, 1996.

Appendix A4.--Barbados. Longline fleet, 1990-99

Year	Longliners		Trips	Activity
	Registered	Active		
	Number		Number	Trips/vessel*
1990	5			
1991	8			
1992	11			
1993	18			
1994	18	13	301	23.2
1995	19	19	231	12.2
1996	25	18	240	13.3
1997	27	19	233	12.3
1998	27	23	269	11.7
1999	28**	19	212	11.2

NA - Not available.
* Mean.
** Began as 30, but one sank and one inactive.
Source: Patrick McConney, Chief Fisheries Officer, personal communications, September 21, 1999 and Christopher Parker, for the Chief Fisheries Officer, personal communications, April 25, 2000.

Appendix A5.--Variable and fixed costs for a 40 ft* (12 m) longliner, 1993-94

Item	Trip	
	Swordfish	Billfish/tuna
	US $**	
Variable costs		
Provisions	1,050/trip	1,050/trip
Fuel	4,706/trip	4,706/trip
Oil	112/trip	112/trip
Bait#	12,000/trip	1,500/trip
Insurance	15,050/year	15,050/year
Gear***	12,000/year	12,000/year
Vessel***	19,500/year	19,500/year
Shipping	1.50/kg	1.50/kg
Fish toll	0.08/kg	0.80/kg
Ice	0.01/kg	0.01/kg
Administrative****	7 percent	7 percent
Wages/crew shares	50,000	40,000
Owner wage	15,000	15,000
Fixed costs		
Cash--Loan payment##		
Vessel	9,380	9,380
Engine	2,800	2,800
Longline gear	3,150	3,150
Truck	3,080	3,080
Crane	980	980
Opportunity		
Return to investment	4,125	4,125
Depreciation###		
Vessel	3,015	3,015
Engine	1,200	1,200
Longline gear	2,025	2,025
Truck	1,980	1,980
Crane	630	630

* Source also contains cost data for 50, 75, 100 ft longliners. The authors decided this data set was most informative about the size vessels which were being most commonly used by Barbadian fishermen.
** Unless otherwise specified.
*** Repair and maintenance.
**** And miscellaneous costs.
# Significant difference between swordfish and billfish/tuna trips.
Capital plus interest: Loan payments for the first year are calculated on 70 percent of the total amount financed (this is the fraction financed by the Barbados Development Bank) at a 10 percent annual percentage rate (APR) calculated on a reducing balance method.
In calculating depreciation, the following conditions were considered. Life span of the vessel is 20 years, engine 15 years, longline gear 10 years, truck and crane 10 years. A salvage value of 10 percent of the original value was considered after the life span.
Source: W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1994), p. 163.

Appendix B1.--Barbados. Longline catch per unit effort (CPUE), 1994-98

Species	Year				
	1994	1995	1996	1997	1998
			Kg/trip*		
Dorado	117.7	102.6	68.4	174.4	87.5
Shark	24.8	24.7	24.8	14.0	10.0
Flyingfish	161.8	112.5	64.8	143.6	247.7
King mackerel	16.5	10.3	4.5	30.5	10.1
Tunas	423.1	498.9	527.3	418.6	468.7
Billfish	233.3	311.5	350.8	380.2	318.4
Swordfish	38.2	83.5	100.2	38.4	40.2

* Mean values.
Source: Christopher Parker, for the Chief Fisheries Officer, personal communications, April 25, 2000.

Appendix B2.--Barbados. Longline landings composition, aggregate data 1994-98

Species	Catch
	Percent
Dorado	9.5
Shark	1.7
Flyingfish	12.9
King mackerel	1.2
Tunas	40.2
Billfish	27.2
Swordfish	5.1
Others	2.3

* Mean values.
Source: Christopher Parker, for the Chief Fisheries Officer, personal communications, April 25, 2000.

Appendix B3a.--Barbados. Swordfish catch rates, operations of two U.S. longliners out of Bridgetown, 1988-89

Month	Catch				
	Trip		Set		Hook
	Quantity	Individuals	Quantity	Individuals	Quantity
	Tons/trip	Fish/trip	Tons/set	Ind./set	Kg/hook
1988					
September	0.9	46	0.2	9	0.6
October	1.2	59	0.2	12	0.7
November	2.6	96	0.4	14	1.1
December	1.1	38	0.3	9	NA
1989					
January	2.6	94	0.4	13	1.3

Source: S. Willoughby, "Operations of U.S. longlines in Barbados," Vols. I and II, *Technical Report* (Fisheries Division: Bridgetown, 1989).

Appendix B3b.--Barbados. Total fish catch, operations of two U.S. longliners out of Bridgetown, 1988-89

Month	Catch				
	Trip		Set		Hook
	Quantity	Individuals	Quantity	Individuals	Quantity
	Tons/trip	Fish/trip	Tons/set	Ind./set	Kg/hook
1988					
September	1.2		0.2		0.8
October	3.0		0.6		1.7
November	4.4		0.6		2.0
December	1.9		0.5		NA
1989					
January	3.1		0.4		1.5

NA - Not available.
Source: S. Willoughby, "Operations of U.S. longlines in Barbados," Vols. I and II, *Technical Report* (Fisheries Division: Bridgetown, 1989).

Appendix B4.--Barbados. Catch composition, two U.S. longliners out of Bridgetown, 1988-89

Year/month	Bycatch*	Catch**
	Percent	
1988 (Sept.-Nov.)		
Swordfish	100#	58
Tuna		34
Bigeye	67	
Yellowfin	33	
Billfish		7
Blue marlin	54	
Sailfish	30	
White marlin	13	
Spearfish	3	
Shark (all mako)	100	1
Dorado***	100	Negl
1988-89 (Dec.-Jan.)		
Swordfish	100#	77
Tuna		18
Bigeye	65	
Yellowfin	35	
Billfish		3
Blue marlin	75	
Sailfish	25	
White marlin	13	
Spearfish	3	
Shark		
Mako	90	
Thresher	10	2
Dorado***	100	Negl

NA - Not available.
Target species.
* By number of individuals.
** By weight.
*** Occasional catches.
Source: S. Willoughby, "Operations of U.S. longlines in Barbados," Vols. I and II, *Technical Report* (Bridgetown: St. Georges, 1989).

Appendix B5a.--Barbados. Methods and catch composition of a Barbadian longliner, May 1988-September 1990

Trip			Line	Set			Bait	Catch*						CPUE*
Type	Number	Sets*	length	Duration	Hooks	Depth		Swordfish	Tuna	Billfish	Shark	Others	Total	
	Number	Number/trip	Kilometers	Time	Number	Meter		Kg/trip						Kg/1,000 hooks
Swordfish	19	3.8	29	6pm-6am	200-250	76-120	Squid**	714	445	230	137	50	1,575	1,842
Billfish	29	3.7	24	3am-1pm	200-250	46-62	Flyingfish	11	572	632	47	200	1,463	1,757

* Mean number per trip.
** With lightsticks.
Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 69.

Appendix B5b.--Barbados. Methods and catch composition of a domestic longliner, May 1988-September 1990

Trip		Catch								Total
Type	Number	Swordfish	Tuna	Billfish	Shark	Dorado	Kingfish	Bonito	Turpit	
	Number	Kilogram								
Swordfish	19	13,564	8,458	4,361	2,603	870	47	24	-	29,926
Billfish/tuna	29	318	16,953	18,331	1,369	2,045	305	13	30	39,003
Total	48	13,882	25,051	22,692	3,972	2,915	352	37	30	68,929

Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 70.

Appendix B6.--Barbados. Catch composition of a domestic longliner, May 1988-September 1990

Species	Catch by trip type	
	Swordfish	Billfish
	Percent	
Swordfish	45.0	1.0
Tuna	28.0	39.0
Billfish	15.0	43.0
Shark	9.0	3.0
Other	3.0	14.0

Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 73.

Appendix B7a.--Barbados. Monthly catch composition on swordfish trips, May 1988-April 1989

Month	Trips	Catch					Total
		Swordfish	Tuna	Billfish	Shark	Others	
	Number	Kg/trip					
January	2	1,415	135	168	40	-	1,758
February	1	764	55	375	31	-	1,225
March	2	725	267	90	28	24	1,135
April	2	521	336	34	135	358	1,385
May	2	558	1,079	143	69	-	1,850
June	2	393	377	217	40	-	1,027
July	2	312	443	34	176	23	989
August	1	381	409	230	914	129	2,062
September	-	-	-	-	-	-	-
October	1	831	914	545	419	-	2,709
November	2	641	400	536	110	-	1,688
December	2	1,228	503	383	21	-	2,135
Overall	19	445**	230	137	NA	50	1,575

NA - Not available.
** As reported in source, but does not appear to compute.
Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 79.

Appendix B7b.--Barbados. Monthly catch composition on swordfish trips, May 1988-April 1989

Month	Trips	Catch		Proportion swordfish
		Swordfish	Total	
	Number	Kg/trip*		Percent
January	2	1,415	1,758	80.5
February	1	764	1,225	62.4
March	2	725	1,135	63.9
April	2	521	1,385	37.6
May	2	558	1,850	30.2
June	2	393	1,027	38.3
July	2	312	989	31.5
August	1	381	2,062	18.5
September	-	-	-	-
October	1	831	2,709	30.7
November	2	641	1,688	38.0
December	2	1,228	2,135	57.5
Overall	19	445**	1,575	NA

NA - Not available.
* Mean.
** As reported in source, but does not appear to compute.
Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 79.

Appendix B7c.--Barbados. Monthly catch composition on billfish/tuna trips, May 1988-April 1989

Month	Trips	Catch					Total
		Swordfish	Tuna	Billfish	Shark	Others	
	Number	Kg/trip					
January	2	10	900	880	-	169	1,959
February	2	-	184	296	16	440	937
March	2	72	1,703	1,525	11	150	3,462
April	3	10	59	979	5	242	1,786
May	4	3	451	183	66	831	1,534
June	3	15	1,210	838	233	3	2,300
July	6	-	364	296	31	10	701
August	4	-	197	726	18	8	949
September	2	31	94	689	38	18	870
October	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-
December	1	-	780	690	-	96	1,566
Overall	29	11	572	632	47	200	1,463

Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 81.

Appendix B7d.--Barbados. Monthly catch composition, July 1989-November 1991

Month	Trips	Catch					Total*
		Swordfish	Tuna	Billfish	Shark	Others	
	Number	Kg/trip					
January	9	48.3	180.8	130.0	-	59.0	418.1
February	17	46.1	107.8	62.7	2.4	186.2	405.1
March	15	4.1	192.5	386.5	9.9	375.0	968.1
April	14	-	412.3	548.3	-	208.2	1,168.8
May	16	24.1	482.3	228.5	-	268.2	1,003.0
June	13	1.5	500.2	199.5	10.3	133.3	844.8
July	30	2.5	143.7	173.4	22.4	23.8	365.7
August	15	-	167.6	292.5	14.4	9.5	484.1
September	18	-	74.0	194.0	21.6	23.8	313.4
October	24	93.2	119.3	219.1	18.5	5.3	455.4
November	12	18.1	214.4	325.0	9.9	39.6	607.0
December	22	28.0	62.9	93.5	1.4	87.6	273.3
Overall	205	23.6	201.5	225.6	10.7	107.7	569.1

Note: Study of 7 Barbadian longliners conducting 205 trips of 1-7 days.
* Totals may not agree due to rounding.
Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 81.

Appendix B7e.--Barbados. Monthly swordfish catches, 1994-99

Month	Year					
	1994	1995	1996	1997	1998	1999
			Metric tons			
January	0.6	4.9	2.3	0.6	2.6	0.7
February	2.6	2.1	2.2	0.9	1.2	0.2
March	1.3	4.6	3.8	1.0	1.8	2.3
April	1.2	2.0	2.4	2.7	0.4	1.5
May	0.2	1.7	3.9	0.9	0.7	0.1
June	0.7	1.2	1.6	0.5	0.4	1.7
July	0.6	1.4	2.2	1.0	0.1	
August	0.2	0.8	0.9	0.4	0.1	
September	0.4	0.1	1.7	1.1	0.5	
October	1.6	0.6	1.3	1.0	1.6	
November	2.2	3.1	1.7	1.3	0.5	
December	0.9	3.7	0.9	0.7	2.0	
Total	12.5	26.2	24.9	12.1	11.9	

Note: Bold figures denote peak month for the year.
Source: Christopher Parker, for the Chief Fisheries Officer, personal communications, April 25, 2000.

Appendix B8.--Barbados. Fishing results off southern Brazil, 1995

ICCAT square*	Catch		Proportion swordfish	Effort
	Swordfish	Total		
	Number of fish		Percent	1,000 hooks
2540	146	264	62	5.75
2545	44	56	79	2.25
3040	344	394	87	1.85
3045	599	780	77	22.35
3050	148	236	63	10.30

* ICCAT square are 5° degree squares of latitude and longitude. The first two numbers are the latitude (in this case 25°-30°S) and the second two numbers are the West longitude. This fix represents the southeastern corner of the 5° square.
Source: IBAMA data cited in ICCAT, *Data Records* Vol. 40 (ICCAT: Madrid, September 1999), p. 13.

Appendix B9.--Barbados. Variations in catches reported by seven domestic longliners, July 1989-November, 1991

Longliner	Species					Total
	Swordfish	Tuna	Billfish	Shark	Others	
			Kilograms*			
1	-	330	240	5	80	655
2	-	60	130	20	30	240
3	-	40	60	5	305	410
4	40	265	250	10	25	590
5	90	395	430	10	120	1,045
6	-	130	210	10	45	395
7	-	25	140	10	20	215

* Data entries roughly estimated from a graphic.
Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 74.

Appendix B10.--Barbados. Longline fleet seasonality, July 1989-November 1991

Month	Catches
	Kg/trip*
January	418
February	405
March	968
April	1,169
May	1,003
June	845
July	366
August	484
September	313
October	450
November	607
December	273
Overall	569

Note: Date based on 205 trips from 1-7 days duration.
* Mean values, operations of 7 longliners.
Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 84.

Appendix C1a.--Barbados. Fisheries catch, 1980-97

Year	Catch
	Metric tons
1980	3,808
1981	3,411
1982	3,480
1983	6,522
1984	5,787
1985	3,915
1986	4,227
1987	3,702
1988	9,097
1989	2,547
1990	2,967
1991	2,074
1992	3,342
1993	2,852
1994	2,585
1995	3,284
1996	3,439
1997	2,764

Source: FAO, *Yearbook of Fishery Statistics*, (FAO: Rome, various years).

Appendix C1b.--Barbados. Fisheries catch, 1985-97

Species	Year												
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	Metric tons												
Freshwater fish	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl
Snappers/jobfishes	114	24	63	14	53	52	34	35	19	26	41	40	26
Flyingfish	1,914	2,661	2,436	5,936	1,423	1,670	1,093	1,461	1,987	1,640	1,766	2,042	1,566
Carangids	93	54	12	6	31	14	23	31	28	15	24	28	19
Dorado/dolphin	1,278	912	708	2,011	670	906	715	1,470	513	499	758	849	721
Seerfishes	120	138	159	332	68	51	45	51	55	36	42	49	47
Tunas													
Skipjack	36	33	21	235	11	11	6	3	4	12	6	5	5
Yellowfin	57	39	57	3	75	89	54	112	100	156	224	160	151
Billfish	105	141	117	333	92	102	44	84	59	96	179	128	141
Sharks/rays	51	48	51	134	37	18	14	24	18	22	24	25	14
Other marine fish	147	177	78	93	87	54	46	71	69	83	220	113	74
Marine crustaceans	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl
Marine mollusks	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl
Total	3,915	4,227	3,702	9,097	2,547	2,967	2,074	3,342	2,852	2,585	3,284	3,439	2,764

Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix C1c.--Barbados. Fisheries catch

Species	Year				
	1993	1994	1995	1996	1997
	Metric tons				
Billfish	99				
Bonito	5				
Brim	22				
Cavally	4				
Dorado	853				2,011
Flying fish	3,300				5,936
Jacks	43				
King mackerel	91				332
Sharks	30				134
Snapper	9				14
Swordfish	5				
Tunas					238
Albacore	12				NA
Other	154				NA
Other					432

Source: Agricultural Planning Unit, Ministry of Agriculture and Rural Development, unpublished statistics (1993 data) and Martyn Melhuish, "Barbados: Flying fish paradise," *Fishing News International*, April 1999, pp. 10-11 (1997 data).

Appendix C2a.--Barbados. Oceanic pelagic catch, 1988-97

Species	Year									
	1988*	1989	1990	1991	1992	1993	1994	1995	1996	1997
	Metric tons									
Tunas										
Large	NA	NA	NA	NA	NA	NA	NA	NA	NA	151.0
Small	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.0
Total	233.0	36.0	87.0	71.0	112.0	167.0	162.0	NA	NA	156.0
Billfish	333.0	76.0	102.0	58.0	84.0	99.0	91.0	NA	NA	118.0
Wahoo**	332.0	87.0	51.0	60.0	51.0	91.0	82.0	NA	NA	47.0
Sharks	134.0	33.0	18.0	19.0	24.0	18.0	22.0	NA	NA	14.0
Swordfish										12.0
Total	1,032.0	232.0	258.0	208.0	271.0	375.0	357.0	NA	NA	503.0

NA - Not available.
Note: Discrepancies with appendix C2b are unexplained.
* Unusually large catches reported in 1988 are unexplained.
** Mostly *Acanthocybium solandri*, but includes king mackerel (*Scomberomorus cavalla*) and frigate tuna (*Auxis thazard*).
Source: Pelagic and Reef Fishes Resource Assessment Unit, "Report of the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP)," *ICCAT Collective Volumes of Scientific Papers*, SCRS/94/128, pp. 262-265 and 1995 update, in press (1988-94 data); and CFRAMP, "Report of the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP)" (SCRS/98/102) (1997 data).

Appendix C2b.--Barbados. Oceanic pelagic catch, 1988-97

Species	Year										
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	Metric tons										
Tunas											
Skipjack	21F	3	9N	11N	14	5E	6	6	6	5	5
Yellowfin	57F	236	62N	89N	108	179E	161	156	255	160F	151
Total	78F	239	71N	100N	122	184E	167	161	261	165	156
Billfish	13E	163N	83A	102A	58A	84A	100X	91A	148A	65E	118X
King mackerel**	318X	664X	119X	102X	105X	102X	146X	118X	84X	84X	47
Sharks	NA	134	33	18	19	24	18	22	24	25	14
Swordfish	-	-	-	-	-	-	-	-	-	-	12
Other	-	-	-	-	71E	112E	167E	162E	255E	68	-
Total	409	1,200	306	322	375	506	598	554	772	407	347

A - Aggregate data subdivided by ICCAT.
E - ICCAT estimate.
N - Estimate by national scientist.
NA - Not available.
X - More than one source.
Note: Discrepancies with appendix C2a are unexplained.
* Unusually large catches reported in 1988 are unexplained.
** Probably includes wahoo.
Source: Various sources (The authors have drawn the data in part from appendix C1b so that annual totals are comparable numbers.)

Appendix C3.--Barbados. Swordfish catch, 1985-98

Year	Barbados Catch			U.S.	
	BDF*	FAO**	ICCAT***	Catch#	Imports##
			Metric tons		
1985	NA	-	-	-	-
1986	NA	-	-	-	-
1987	NA	-	-	-	-
1988	NA	-	-	59.0	32.0
1989	NA	-	-	60.7	100.7
1990	NA	-	-	-	1.1
1991	NA	-	-	-	-
1992	NA	-	-	1.0	8.4
1993	NA	-	-	3.1	5.0
1994	17.9	-	-	5.6	12.7
1995	37.4	-	-	23.6	90.4
1996	35.6	-	-	64.1	59.1
1997	17.3	-	12.0	115.6	101.7
1998	17.0	-	16.0	30.4	36.9

* Barbados Department of Fisheries (BDF) landings data (appendix B7e) to live weight (the landed trunk is about 70 percent of live weight).
** FAO does not list swordfish as a separate entry.
*** ICCAT data is either data published in the *Statistical Bulletin* or released by the SCRS at various ICCAT meetings.
# U.S. landings in Barbados live weight (appendix C3c). Some data is also available from the BDF on landings by U.S. fishermen (appendix C3c).
U.S. imports converted to live weight.
Note: Live-weight conversions computed with a conversion factor of 1.4.
NA - Not available.
Source: Christopher Parker, Barbados Department of Fisheries, personal communications, April 25, 2000 (Barbados landings data); FAO, *Yearbook of Fishery Statistics*, various years (Barbados catch data); ICCAT, *Statistical Yearbook*, various years (Barbados catch data); NMFS Southeast Fisheries Science Center-F/SEC, unpublished data, (U.S. catch data); and U.S. Bureau of the Census, unpublished data (U.S. import data).

Appendix C3a1.--Barbados. Possible swordfish catch, 1985-99

Year	U.S. Catch#	U.S. Imports##	Barbados Share
	Metric tons		
1985	-	-	-
1986	-	-	-
1987	-	-	-
1988	59.0	32.0	-27.0
1989	60.7	100.7	40.0
1990	-	1.1	1.1
1991	-	-	-
1992	1.0	8.4	7.4
1993	3.1	5.0	1.9
1994	5.6	12.7	7.1
1995	23.6	90.4	66.8
1996	64.1	59.1	-5.0
1997	115.6	101.7	-13.9
1998	30.4	36.9	6.5
1999		68.4	

Note: Subtracting U.S. catches landed in Barbados from swordfish shipped to the United States is a possible indicator of domestically caught swordfish. It is an imperfect indicator, but does help to confirm other indicator and provide some insight on the years for which other data is not available.
U.S. landings in Barbados live weight (appendix C3c). Some data is also available from the BDF on landings by U.S. fishermen (appendix C3c).
U.S. imports converted to live weight.
Note: Live-weight on versions computed with a conversion factor of 1.4.
NA - Not available.
Source: Christopher Parker, Barbados Department of Fisheries, personal communications, April 25, 2000 (Barbados landings data); FAO, *Yearbook of Fishery Statistics*, various years (Barbados catch data); ICCAT, *Statistical Yearbook*, various years (Barbados catch data); NMFS Southeast Fisheries Science Center (F/SEC), unpublished data, (U.S. catch data); and U.S. Bureau of the Census, unpublished data (U.S. import data).

Appendix C3b.--Barbados. Swordfish catch reported by medium-sized longliners, July 1989 through November 1991

Month	Catch*
	Kilograms/trip
October	95
November	15
December	20
January	45
February	40
March	5
April	-
May	25
June	Negl
July	5
August	-
September	95

* Data points are approximations, estimated from a graphic, figure 8 in source.
Note: 7 medium-sized vessels, 205 trips.
Source: W. Hunte, H. Oxenford, P. McConney, and G. Dharmarante, "The feasibility of developing longline fisheries in Barbados," *Barbados Development Bank Technical Report*, (Bridgetown: Barbados Development Bank, 1993), p. 30.

Appendix C3c. Barbados. U.S. transhipments through Barbados, 1885-99

Year	U.S. Transhipments	
	BDF	NMFS
	Metric tons	
1986		-
1986		-
1987		-
1988		41.3
1989		-
1990		-
1991		-
1992		0.7
1993		2.2
1994		3.9
1995		16.9
1996	57.0	45.8
1997	67.0	76.4
1998	NA	21.7
1999	NA	40.8

Sources: BFD and NMFS Southeast Fisheries Center.

Appendix C3c1.--Barbados. Landings of large pelagic species by domestic and foreign* vessels

Species	Domestic		Foreign*		Total	
	1996	1997	1996	1997	1996	1997
			Metric tons			
Tunas						
Albacore	24	Negl	2	-	26	Negl
Other**	137	149	293	402	430	551
Swordfish	25	12	57	267	82	279
Dorado	708	605	7	4	715	609
King mackerel	41	39	1	1	42	40
Shark	21	12	1	1	22	13
Total	956	817	361	675	1,317	1,492

* Transhipments.
** Yellowfin and bigeye.
Source: Patrick McConney, Chief Fisheries Officer, personal communications, September 21, 2000.

Appendix C3d1.--United States. Monthly swordfish landings in Barbados, by size, 1988

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds													
01- 20	1	8	22	30	30	41	17	17	80	74	38	31	389
21- 40	18	18	45	35	56	50	17	7	29	57	69	72	473
41- 60	18	15	22	21	21	24	10	2	12	28	58	56	287
61- 80	4	10	11	9	13	16	5	4	15	15	61	34	197
81-100	4	6	18	10	6	17	4	4	10	18	59	23	179
101-120	2	4	6	8	5	10	2	2	4	7	21	10	81
121-140	1	2	1	5	5	7	1	2	1	8	4	6	43
141-160	-	1	-	3	3	1	1	1	2	5	3	2	22
161-180	-	-	-	2	1	1	-	-	3	3	1	1	12
181-200	-	-	-	-	3	2	-	-	1	1	-	1	8
201-220	-	-	-	-	-	1	-	1	-	1	-	3	6
221-240	-	-	-	-	-	-	-	-	-	-	1	2	3
241-260	-	-	-	-	-	-	-	-	-	-	2	-	2
261-280	-	-	-	-	-	1	-	-	-	1	-	-	2
281-300	-	-	-	-	-	-	1	-	-	-	-	-	1
321-340	-	-	-	-	-	-	-	-	-	-	1	-	1
341-360	-	-	-	-	-	-	-	-	-	1	-	-	1
361-380	-	-	-	-	-	-	-	-	-	-	1	1	2
421-440	-	-	-	-	-	-	-	-	-	-	-	1	1
441-460	-	-	-	-	-	-	-	-	-	-	1	-	1
Total	48	64	125	123	143	171	58	40	157	219	320	243	1,711

Source: NMFS Southeast Fisheries Science Center.

Appendix C3d2.--United States. Monthly swordfish landings in Barbados, by size, 1989

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds													
01- 20	67	102	91	7	10	1	0	0	0	0	0	0	278
21- 40	124	144	112	23	46	25	0	0	2	0	0	0	476
41- 60	103	70	60	16	23	11	0	0	2	0	0	0	285
61- 80	72	44	28	9	13	8	0	0	0	0	0	0	174
81-100	40	34	29	15	7	11	0	0	0	0	0	0	136
101-120	29	8	16	9	6	6	0	0	1	0	0	0	75
121-140	9	4	10	5	6	5	0	0	0	0	0	0	39
141-160	3	6	4	2	1	4	0	0	0	0	0	0	20
161-180	5	2	5	0	3	0	0	0	0	0	-	-	15
181-200	2	2	2	1	3	1	-	-	-	-	-	-	11
201-220	1	1	2	2	-	-	-	-	-	-	-	-	6
221-240	-	-	2	-	1	1	-	-	-	-	-	-	4
241-250	2	-	1	1	1	-	-	-	-	-	-	-	5
261-280	4	-	2	1	-	-	-	-	-	-	-	-	7
291-310	2	1	2	3	-	-	-	-	1	-	-	-	9
321-340	2	-	1	-	-	-	-	-	-	-	-	-	3
341-350	1	1	-	-	-	-	-	-	-	-	-	-	2
361-380	2	1	-	-	1	-	-	-	-	-	-	-	4
381-400	1	1	1	-	1	-	-	-	-	-	-	-	4
401-420	1	1	1	-	-	-	-	-	-	-	-	-	3
431-440	-	1	-	-	-	-	-	-	-	-	-	-	1
451-460	1	-	-	-	-	-	-	-	-	-	-	-	1
471-490	-	-	1	-	-	1	-	-	-	-	-	-	2
Total	471	423	370	94	122	74	0	0	6	0	0	0	1,560

Source: NMFS Southeast Fisheries Science Center.

Appendix C3d3.--United States. Monthly swordfish landings in Barbados by size, 1992

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
21- 40	-	-	-	1	-	-	-	-	-	-	-	-	1
41- 60	-	-	-	4	-	-	-	-	-	-	-	-	4
61- 80	-	-	-	4	-	-	-	-	-	-	-	-	4
101-120	-	-	-	3	-	-	-	-	-	-	-	-	3
121-140	-	-	-	2	-	-	-	-	-	-	-	-	2
141-160	-	-	-	1	-	-	-	-	-	-	-	-	1
221-240	-	-	-	1	-	-	-	-	-	-	-	-	1
Total	-	-	-	16	-	-	-	-	-	-	-	-	16

Source: NMFS Southeast Fisheries Science Center.

Appendix C3d4.--United States. Monthly swordfish landings in Barbados by size, 1993

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
21- 40	-	-	2	6	2	-	-	-	-	-	-	-	10
41- 60	-	-	4	4	4	-	-	-	-	-	-	-	12
61- 80	-	-	3	8	4	-	-	-	-	-	-	-	15
81-100	-	-	4	5	1	-	-	-	-	-	-	-	10
101-120	-	-	2	5	1	-	-	-	-	-	-	-	8
121-140	-	-	1	3	-	-	-	-	-	-	-	-	4
141-160	-	-	-	-	1	-	-	-	-	-	-	-	1
181-200	-	-	1	-	-	-	-	-	-	-	-	-	1
301-320	-	-	-	1	-	-	-	-	-	-	-	-	1
Total	-	-	17	32	13	-	-	-	-	-	-	-	62

Source: NMFS Southeast Fisheries Science Center.

Appendix C3d5.--United States. Monthly swordfish landings in Barbados, by size, 1994

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pounds	Number of fish												
21- 40	-	-	3	6	15	-	-	-	-	-	-	-	24
41- 60	-	-	2	9	16	-	-	-	-	-	-	-	27
61- 80	-	-	1	6	8	-	-	-	-	-	-	-	15
81-100	-	-	4	5	5	-	-	-	-	-	-	-	14
101-120	-	-	-	2	10	-	-	-	-	-	-	-	12
121-140	-	-	-	6	5	-	-	-	-	-	-	-	11
141-160	-	-	-	-	4	-	-	-	-	-	-	-	4
161-180	-	-	-	-	2	-	-	-	-	-	-	-	2
181-200	-	-	1	-	-	-	-	-	-	-	-	-	1
281-300	-	-	1	-	-	-	-	-	-	-	-	-	1
Total	-	-	12	34	65	-	-	-	-	-	-	-	111

Source: NMFS Southeast Fisheries Science Center.

Appendix C3d6.--United States . Monthly swordfish landings in Barbados by size, 1995

Weight	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pound	Number of Fish												
01- 20	-	-	2	1	-	-	-	-	-	-	-	-	3
21- 40	-	-	25	40	8	6	-	-	-	-	-	-	79
41- 60	-	-	39	37	17	11	-	-	-	-	-	-	104
61- 80	-	-	23	41	8	9	-	-	-	-	-	-	81
81-100	-	-	16	26	6	5	-	-	-	-	-	-	53
101-120	-	-	22	13	12	5	-	-	-	-	-	-	52
121-140	-	-	15	8	8	5	-	-	-	-	-	-	36
141-160	-	-	10	2	9	1	-	-	-	-	-	-	22
161-180	-	-	8	2	2	1	-	-	-	-	-	-	13
181-200	-	-	2	-	-	2	-	-	-	-	-	-	4
201-220	-	-	1	-	-	-	-	-	-	-	-	-	1
221-240	-	-	1	1	-	-	-	-	-	-	-	-	2
261-280	-	-	-	1	-	1	-	-	-	-	-	-	2
321-340	-	-	1	-	-	-	-	-	-	-	-	-	1
341-360	-	-	1	-	-	-	-	-	-	-	-	-	1
421-440	-	-	1	-	-	-	-	-	-	-	-	-	1
Total	-	-	165	173	71	46	-	-	-	-	-	-	455

Source: NMFS Southeast Fisheries Science Center.

Appendix C3e1.--United States. Monthly swordfish landings in Barbados, by size, 1988

Weight	Month												Average/Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
						Pounds							
Mean size	51	55	47	50	49	53	46	50	38	50	64	58	53*
Total	2,459	3,533	5,983	6,244	7,036	9,165	2,721	2,036	6,073	10,974	20,618	14,194	91,036

* Average mean size.
Source: NMFS Southeast Fisheries Science Center.

Appendix C3e2.--United States. Monthly swordfish landings in Barbados by size, 1992

Weight	Month												Average/Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
						Pounds							
Mean size	-	-	-	95	-	-	-	-	-	-	-	-	95*
Total	-	-	-	1,525	-	-	-	-	-	-	-	-	1,525

* Average mean size.
Source: NMFS Southeast Fisheries Science Center.

Appendix B3c3.--United States. Monthly swordfish landings in Barbados, by size, 1993

Weight	Month												Average/Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
						Pounds							
Mean size	-	-	77	81	67	-	-	-	-	-	-	-	77*
Total	-	-	1,319	2,612	882	-	-	-	-	-	-	-	4,813

* Average mean size.
Source: NMFS Southeast Fisheries Science Center.

Appendix C3e4.--Barbados. Monthly swordfish catch data, by size, 1994

Weight	Month												Average/Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
						Pounds							
Mean size	-	-	93	75	77	-	-	-	-	-	-	-	78*
Total	-	-	1,119	2,562	5,024	-	-	-	-	-	-	-	8,705

* Average mean size.
Source: Southeast Fisheries Science Center.

Appendix C3e5.--United States. Monthly swordfish landings, by size, 1995

Weight	Month												Average/Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
						Pounds							
Mean size	-	-	90	69	87	86	-	-	-	-	-	-	81*
Total	-	-	14,915	12,039	6,243	3,988	-	-	-	-	-	-	37,185

* Average mean size.
Source: NMFS Southeast Fisheries Science Center.

Appendix C3f.--United States. Swordfish landings in Bridgetown, Barbados, 1988-99

Year	Caught north of 5°N		Caught south of 5°N		Total*	
	Trunks	Liveweight	Trunks	Liveweight	Trunks	Liveweight
			Metric tons			
1988	41.3	59.0			41.3	59.0
1989	42.5	60.7			42.5	60.7
1990	-	-	-	-	-	-
1991	-	-	-	-	-	-
1992	0.7	1.0	-	-	0.7	1.0
1993	2.2	3.1	-	-	2.2	3.1
1994	3.9	5.6	-	-	3.9	5.6
1995	16.9	23.5	Negl	0.1	16.9	23.6
1996	29.5	41.3	16.3	22.8	45.8	64.1
1997	11.5	16.4	66.6	95.1	78.1	115.6
1998	8.9	12.5	12.8	17.9	21.7	30.4
1999	2.5	3.6	38.4	54.9	40.8	58.3

* Totals may not agree due to rounding.
Source: Southeast Fisheries Science Center, National Marine Fisheries Service.

Appendix C3g. Foreign countries. Swordfish catches in ICCAT square 1055*

Country	Year	Quarter 1	2	3	4	Total
		Metric tons				
Cuba	1981		0.1			0.1
	1984		0.3		3.5	3.8
	1985				0.5	0.5
	1986			0.5		0.5
	1987			0.4		0.4
	1989			0.1		0.1
	1990				1.2	1.2
	1991				0.6	0.6
	1992				0.7	0.7
	1993				0.5	0.5
	1994				1.2	1.2
	1995				2.1	2.1
	1996				0.2	0.2
	1997				0.2	0.2
Japan	1959		0.3		0.1	0.4
	1960				0.1	0.1
	1961				0.1	0.1
	1962		0.3	0.1		0.4
	1963		0.3		1.4	1.7
	1964	2.5	5.0	0.4	0.5	8.4
	1965	4.4	1.8	4.5	9.1	19.8
	1966	4.9	0.4	1.8		7.1
	1967	0.3			1.7	2.0
	1968	1.1	0.5	0.1		1.7
	1969	0.1			0.1	0.2
	1970		0.1	0.2		0.3
	1971		0.3	0.1	0.2	0.6
	1972	0.3				0.3
	1974			0.2		0.2
	1979		0.2	0.1		0.3
	1982	0.3	1.2	2.5	0.7	4.7
	1983	0.1		0.2	0.1	0.4
	1984				1.9	1.9
	1985	1.9	0.2		0.9	3.0
	1989		0.2			0.2
Korea	1977		0.4	1.1	0.4	1.9
	1979	0.5	2.3	10.7		13.5
	1980			0.9		0.9
	1981	0.7	0.2	1.3		2.2
	1983	0.4				0.4
	1984			0.2		0.2
	1985				0.3	0.3
	1988		0.2			0.2
	1989		0.2			0.2
Spain	No fishing					
Taiwan	1968	1.0				1.0
	1971			0.4		0.4
	1974		4.1		1.3	5.4
	1985		0.1	0.7		1.7
	1986		0.1			0.1
	1990		1.1			1.1
	1991	2.5	2.2	1.0	1.6	7.3
	1992	1.4	1.4	1.4	1.4	5.6
	1996			1.5	2.8	4.3
	1997	0.3	0.3			0.6
United States	Data not available**					

* ICCAT square are 5° degree squares of latitude and longitude. The first two numbers are the latitude and the second two numbers are the longitude. This represents the southeastern corner of the 5° square for catches in quadrant 4, northwest Atlantic.

** U.S. data at the time of the preparation of this report was not available by 5° squares. ICCAT is in the process of calculating 5° square data from the 1° square data currently available.

Source: ICCAT: http://www.iccat.es/Stats.html, retrieved July 3, 2000.

Appendix C4.--Barbados. Billfish catch, 1963-97.

Year	Marlin		Sailfish	Total
	Blue	White		
		Metric tons		
1963	-			NA
1964	-			NA
1965	-			NA
1966	-			NA
1967	-			NA
1968	-			NA
1969	-			NA
1970	NA			NA
1971	NA			NA
1972	NA			NA
1973	NA			NA
1974	183			183
1975	150			150
1976	120			120
1977	81			81
1978	72			72
1979	51			51
1980	73			73
1981	117			117
1982	99			99
1983	126			126
1984	126			126
1985	10			10
1986	14E	Negl	Negl	14E
1987	13E	Negl	Negl	13E
1988	46N	117N	Negl	163N
1989	3A	11A	69A	83A
1990	18A	39A	45A	102A
1991	12A	17A	29A	58A
1992	18A	24A	42A	84A
1993	21A	29A	50A	100A
1994	19A	26A	46A	91A
1995	31A	43A	74A	148A
1996	25E	15E	25E	65E
1997	25*	34E	59E	118

A - Officially reported catches that have been further subdivided by gear and/or area by the ICCAT SCRS.
E - Estimated by the SCRS or SCRS working group. Includes estimates by national scientists or by the ICCAT Secretariat which have been reviewed and approved by SCRS.
N - Estimates by national scientists that do not agree with official statistics or when official statistics are unavailable.
* - Includes some white marlin.
Source: ICCAT, "Report of the Standing Committee on Research and Statistics," *ICCAT Report*, Part II, 1992-93 (ICCAT: Madrid, Spain, 1994), pp. 254-258.(1963-85 data) and ICCAT, *Yearbook of Fishery Statistics*, various years (1986-97 data).

Appendix D.--Barbados. Pelagic market prices, 1993

Species/ product form	Price	Sale point
	US$/Kg	
Swordfish		
Fresh logs*	5.51-8.82	Hotels
Tunas		
Fresh H&G	2.54-4.63	Dockside
Fresh steaks	2.43-6.06	Fish market
Billfish		
Fresh H&G	2.54-5.29	Dockside
Fresh steaks	3.97-6.72	Fish market
Dorado (dolphin)		
Fresh		
Gutted	2.87-6.06	Dockside
Steaks/fillets	4.41-7.28	Fish market
Frozen steaks/fillets	9.26	Super market
Cryovak steaks/fillets	10.36-11.68	Super market
Wahoo		
Fresh		
Gutted	2.87-6.28	Dockside
Steaks/fillets	4.63-7.50	Fish market
Frozen steaks	7.94	Super market
Cryovak filets	12.57	Super market
Shark		
Fresh H&G	2.09-3.86	Dockside
Fresh steaks	3.20-5.07	Fish market

* Trunks.
Source: Reported in W. Hunte, H. P. Oxenford, and G. Mc Conney, and G. Dharmarante, in "The feasibility of developing longline fisheries in Barbados, *Barbados Development Bank Technical Report* (Barbados Development Bank: Bridgetown, 1993), p. 101.

Appendix E1.--Barbados. Swordfish exports by destination, 1990-2000

Destination	Year										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	Metric tons*										
United States**	1	-	6	4	9	63#	41#	71#	26#	48#	18#
Japan***	-	-	-	-	-	-	-	-	-	-	NA
European Union	NA	-	-	-	-	-	-	-	-	-	-
Others##	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	1	-	6	4	9	63	41	71	26	48	18

NA - Not available.
Some of this product is transhipments by U.S. fishermen rather than exports of Barbados-caught fish (appendix C3c).
Swordfish shipments to other countries are believed to be non-existent or negligible.
* Product Weight.
** Data available through June, 2000.
*** Data available through November, 1999.
Source: Various.

Appendix E2a1.--United States. Swordfish imports from Barbados, 1975-2000

Year	Commodity		Total*
	Fresh	Frozen	
	Metric tons		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985	-	-	-
1986	-	-	-
1987	-	-	-
1988	22.0	0.4	22.4
1989	70.5	-	70.5
1990	0.8	-	0.8
1991	-	-	-
1992	5.9	-	5.9
1993	3.5	-	3.5
1994	8.9	-	8.9
1995	63.3	-	63.3
1996	41.4	-	41.4
1997	71.2	-	71.2
1998	25.8	-	25.8
1999	39.1**	8.8	47.9
2000	18.0***	-	18.0***

* Totals may not agree due to rounding.
** Includes 0.6 t of steaks.
*** Data available through June.
Source: U.S. Bureau of the Census.

Appendix E2a2.--United States. Swordfish imports from Barbados, 1975-2000

Year	Commodity		Total*
	Fresh	Frozen	
	US$1,000		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985	-	-	-
1986	-	-	-
1987	-	-	-
1988	152	5	157
1989	522	-	522
1990	8	-	8
1991	-	-	-
1992	26	-	26
1993	16	-	16
1994	44	-	44
1995	318	-	318
1996	245	-	245
1997	425	-	425
1998	159	-	159
1999	255**	58	313**
2000	120***	-	120***

* Totals may not agree due to rounding.
** Includes $3,400 of steaks.
*** Data available through June.
Source: U.S. Bureau of the Census.

Appendix E2b.--United States. Swordfish and tuna imports from Barbados, 1990-2000

Year	Species		Total*
	Swordfish	Tuna	
	US$1,000		
1990	8	30	38
1991	-	62	62
1992	26	202	228
1993	16	483	499
1994	44	889	933
1995	318	1,996	2,314
1996	245	1,497	1,742
1997	425	1,979	2,404
1998	159	1,379	1,538
1999	313	1,005	1,318
2000	120**	401**	521**

* Totals may not agree due to rounding.
** Data available through June.
Source: U.S. Bureau of the Census.

Appendix E2c.--United States. Monthly swordfish imports from Barbados, 1990-2001

Month	Year											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001#
						Metric tons						
January	0.2	-	-	2.7	0.2	4.9	2.5	2.9	2.0	-	-	-
February	0.2	-	-	-	1.5	16.2	6.5	5.0	1.1	-	2.2	-
March	0.2	-	-	-	2.0	13.9	6.0	10.8	10.0	2.3	6.8	
April	0.2	-	-	-	1.1	10.6	6.6	25.5	1.9	22.6*	8.3	
May	-	-	-	-	2.3	6.0	2.1	0.5	1.1	14.3*	0.5	
June	-	-	-	0.2	-	4.6	3.5	12.6	9.4	8.1**	0.3	
July	-	-	-	-	0.6	3.3	10.2	3.9	-	-	-	
August	-	-	-	-	-	0.5	0.5	-	-	-	0.3	
September	-	-	-	0.5	-	0.2	0.8	0.7	-	-	1.0	
October	-	-	-	-	0.9	-	0.2	1.8	-	-	-	
November	-	-	1.1	-	-	0.4	1.7	3.9	0.4	0.7	1.5	
December	-	-	4.8	-	0.4	2.6	0.7	3.6	-	-	-	
Total	0.7	-	5.9	3.5	8.9	63.3	41.4	71.2	25.8	47.9	20.9	

Note: Peak month noted with in bold type.
Data available through February 2001.
* Includes small quantity of frozen product.
** Includes small quantity of steaks.
Source: U.S. Bureau of the Census.

Appendix E3.--European Union. Swordfish imports from Barbados, 1991-99

Commodity	Years								
	1991	1992	1993	1994	1995	1996	1997	1998	1999
				Metric tons					
Fresh	-	-	-	-	-	-	-	-	-
Frozen	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-

Source: EU. NIMEXE.

Appendix F.--Barbados. Sport fishing tournaments, 1999

Date*	Location
February 21	Fisherman's Corner
March 7	Esso Payne's Bay/BGFA
March 20	G B Coral Block
April 11	ACP Associates
April 24-25 and 27	Mutual/Mount Gay International Tournament

* Normally held approximately the same time each year.
Updates available at: http://barbados.org/fishing/bgfa/index.htm.
Source: Barbados Game Fishing Association.

Appendix G.--Barbados. Species glossary

Barbados	American	Scientific
Billfish	Billfish	Istiophoridae
Bonito*	Frigate mackerel	Sarda sarda
Brim		Etelis oculatus
Dolphin	Dorado/mahi-mahi	Coryphaena hippurus
Flying fish	Flying fish	Hirundichthys affinis
Jacks		Caranx sp.
Cavally		Caranx hippos
Kingfish/peto	King mackerel/wahoo	Acanthocybium solandri
Shark	Shark	Carcharhinidae
Snappers	Snappers	Lutjanidae
Swordfish	Swordfish	Xiphias gladius
Tunas	Tunas	Thunnus sp.
Albacore**	Albacore	T. alalunga
Tunny	Bluefin	T. thunnus

* Barbados fishermen often sometimes refer to skipjack as bonito.
* Barbados fishermen often sometimes refer to bigeye and yellowfin as albacore.
Sources: Various.

5.4 Large Pelagics

5.4.1 Management Plan for Large Pelagics

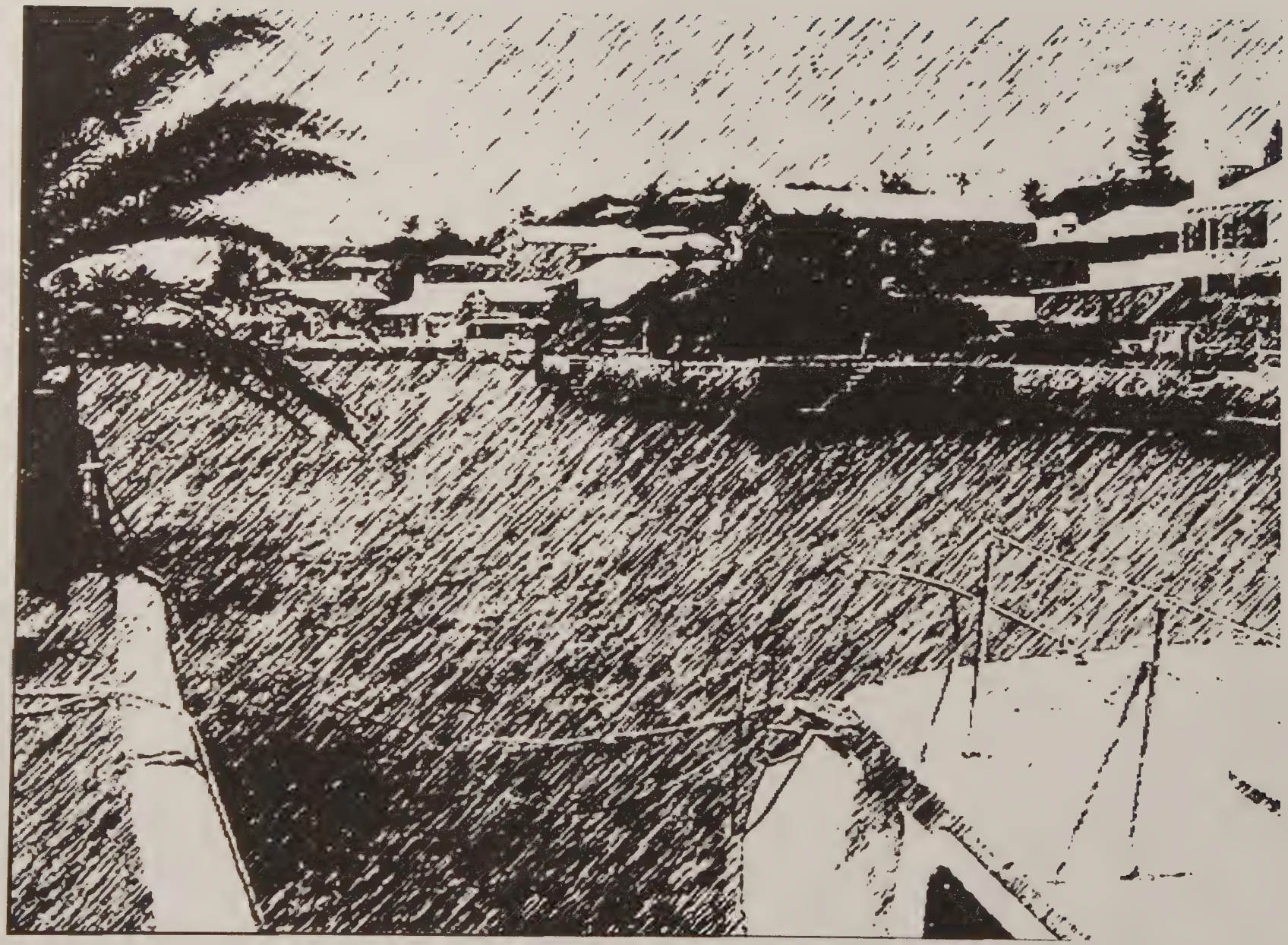
Target Species	Tunas (*Scombroidei*) Wahoo (*Acanthocybium solandri*) - also called "kingfish" locally Billfishes (*Istiophoridae)* Dolphinfish (*Coryphaena hippurus*) Swordfish (*Xiphias gladius*) Mackerels (*Scombermorous spp.*)
By-catch	Sharks (*Elasmobranchii*)
Ecology	*Distribution* - Most species are highly migratory. Stocks which are probably contained within the Caribbean region are dolphin, kingfish, wahoo, and blackfin tuna. Stocks believed to extend throughout the Atlantic are bigeye tuna, yellowfin tuna, skipjack tuna, billfishes, and swordfish. Determinants of local distribution include temperature, bottom topography, salinity, prey abundance and currents. *Growth* - Growth rate is highly variable among species. Tunas, sharks and billfish can grow 2-4 metres in length. *Life span* - Except for dolphinfish which has a life-span of between 3 and 5 years, most species are relatively long-lived. *Reproduction* - Spawning areas are poorly known for most species.
Description of Fishery	*Economic importance* - Longlining has become the major recent harvest sector investment area in Barbados, with high capital and operating costs, and potentially high returns from export of good quality fish (grades 1 and 2). Also, some USA flagged vessels trans-ship tunas through local fish processors. Longliners target tunas and swordfish, with by-catches mainly of billfishes (blue marlin, white marlin, sailfish) and shark. *Vessel type* - Longliners and iceboats *Fishing gear and methods* - Most large pelagics, but mainly dolphin and wahoo, are usually harvested on the same dayboat and iceboat fishing trips, often together with flyingfish. Fishing methods include trolling and lurk-lining. With range being proportional to size, local boats fish within national waters and on the high seas amongst international fleets. *Landing sites* - Mainly at the Bridgetown Fishing Complex. Some also landed at Oistins with small quantities at secondary landing sites on south and west coasts. Fish for trans-shipment is of-loaded at the Bridgetown Port. *Employment* - Becoming increasingly important for more skilled fishers

	Illegal foreign fishing is suspected but has not been verified or quantified.
Management Unit	The eastern Caribbean is considered to be the minimum management unit for the regional large pelagics which are shared between the islands. For most tunas, billfish and swordfish, ICCAT uses the western Atlantic or the entire Atlantic Ocean as the management unit, and these stocks are shared or straddling.
Resource Status	While ICCAT reports many large tuna species to be fully exploited or over-exploited for the Atlantic in general, the status of most other tuna and tuna-like species in the western Atlantic and Caribbean is uncertain. Based on crude estimates of potential yield from hypothetical EEZs some stocks are believed to be adequate to allow for expansion of the fishery. The potential annual yields for important oceanwide species within the marine area of Barbados are: yellowfin - 767 metric tons (MT); albacore - 115 MT; bluefin tuna - 19 MT; skipjack - 223 MT; bigeye tuna - 182 MT (Singh-Renton and Neilson, 1993).
Catch and Effort Trends	Annual estimated catches of large pelagics between 1986 and 1995 varied between about 700 and 1200 tonnes (Source: Fisheries Division - Barbados). No trends are apparent except for fairly steady increases in tuna and swordfish landings. Fishing effort directed at large pelagics has increased due both to an increase in the number of iceboats and the growth of the longline fleet in number and average size of vessel.
Regulatory History	The harvest of large pelagics in Barbados and the eastern Caribbean is not regulated. However, ICCAT sets regulations for the entire Atlantic and these are expected to be complied with, especially when the UN Agreement relating to the conservation and management of straddling fish stocks and highly migratory fish stocks comes into force. Some of the current ICCAT management measures include country quotas for the major fishing nations (e.g. 3500 MT swordfish for the USA) and minimum sizes for particular species (e.g. 25 kg or 125 cm from lower jaw to tail fork for swordfish).
Management Policies and Objectives	Maximize, within regional or international guidelines for conservation, the catches of large pelagics taken by national and regional fishermen through ensuring that there is a fair and equitable distribution of these resources among the users.
Selected Management Approaches	Comply with ICCAT and other applicable management measures within the context of regional and international agreements. Promote the establishment of a regional organization or arrangement for making co-ordinated management decisions concerning shared resources. Cooperate and collaborate with Caribbean states and ICCAT to assess and manage the resources.
Development Constraints	Large tunas and billfishes may be fully exploited or overexploited Increasing conservation regulation by international agreements and organizations is likely.

	Substantial investment required for harvest by large longliners. Fishing harbour and port facilities are not suited to large fishing vessels.
Development Opportunities	Possible scope for increased effort on resources within the EEZ. International agreements make special case for assisting developing countries to attain equitable shares of fishery resources. Export markets exist, especially for tunas and swordfish. High local demand for dolphin and other regionally distributed species. Use of fish aggregating devices (FADS) to increase catches or catch rates

5.4.2 Implementation of Large Pelagics Management Plan

ISSUES IDENTIFIED	PLANNED ACTION	IMPLEMENTATION STRATEGY	RESOURCES REQUIRED
Fishing area restricted in the Caribbean	Seek access for local boats to areas where fishes are abundant	Negotiate fishing access agreements with neighbouring states	- Operational support for a negotiating team - Information on fishery resource distribution - Regional fishing agreements
Lack of regional mechanism for managing shared resources	Encourage formation of a regional decision-making mechanism for fishery resources	- Continue close cooperation with the OECS - Support CFRAMP in researching the most feasible arrangement or organization - Become party to international agreements that facilitate managing shared stocks - Engage in joint research which provides information for decision-making	- Funds to attend regional and international meetings - Funds, equipment and personnel to participate in research projects - Funds for membership in organizations - Funds for public education programme on data collection
Inadequate fishery information and statistics for planning and management	Improve the Fisheries Division's research and data collection programme	- Improve estimation of catches - Get better means of measuring effort - Collect biological, economic and social data - Collaborate on data collection with fishers - Participate in ICCAT assessments and data collection	-Additional Fisheries Biologist(s) Computing facilities for data analysis - Scientific literature - Stock assessment training for staff



5

BERMUDA

Bermuda has reported a substantial decline in its overall fisheries catch. The catch has been impaired by both over fishing and pollution. This has required the Government to ban the traditional fishing method, trap fishing, as a way of limiting effort. The Government is interested in diversifying the fishing industry by initiating a commercial longline fishery. The Government has issued licenses to foreign longliners operating around Bermuda. A Cuban longliner in 1998 and 1999 was authorized to land its catch for sale in the domestic market. Some Bermudian fishermen have attempted to initiate longline operations, but with mixed success. Fishermen reported a swordfish catch under 1 ton in 1995-97 and 9 tons in 1998, although much of this was taken by foreign longliners but chartered by Bermudian companies. Bermudian fishermen have deployed three small longliners during the 1990s, only two were reportedly active in 2000. One company is actively attempting to purchase another longliner. Bermuda has issued no current longline licenses to foreign fishermen nor or there any domestic fishermen actively longlining. The local fishermen have little experience with the necessary longline fisheries technology, but a few fishermen through working with foreign fishermen and deploying their own small longliners are gaining experience. Investors are, however, still reluctant to commit the needed investment in longliners and gear and equipment for unknown returns. Nor is it clear that Bermudians, who have access to good paying jobs in the local tourist and financial services sectors, would want to work on such fishing vessels. As a result, local fishermen have not yet developed the island's offshore pelagic resources.

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Figure 1.--Map of Bermuda

I. Overview

A. General

Bermuda was discovered by Spanish explorer Juan Bermudez after who the island is named. The Spanish never settled the island which was uninhabited until a party of English settlers headed to America were shipwrecked there. A company was formed and the British Crown took over the government in 1684. The island assumed considerable strategic importance during World War II (1939-45) as a British and American naval and air base in the struggle against the German U-boats to keep the North Atlantic sea lanes open to Britain.

Photo 1.-- A large expanse of the Bermuda coast consist of rugged volcanic rock. Dan Hellin.

Bermuda is a British colony with representative local government under the constitution of 1968. The Governor, appointed by the British monarchy, is normally bound to accept the advice of the Cabinet in all matters except for foreign affairs, internal security, and the police. The Cabinet is appointed from the members of a bicameral legislature on the recommendations of the Prime Minister. Bermuda is made up of about 100-150 small islands, depending on the size of islet included. Only 20 of these islands are actually inhabited. Bermuda is located in the western Atlantic (32°N, 64°W) about 900 kilometers miles off the coast of Cape Hatteras, North Carolina. (The island is included in the Caribbean chapter of this report for organizational simplicity.) The total land area is about 53 square kilometers.

Bermuda's economy is one of the most successful and fastest growing in the wider-Caribbean area. Per capita income exceeds that of almost all the Caribbean islands. The economy is based on the tourist and financial services industries. The fishing industry makes only a minor contribution to the island's economy. Fishery resources are, however, one of the few natural resources available to Bermudians.

B. Fishing industry

Bermuda has only a small fishing industry. Subsistence fishing dates back to the colony's settlement in the 17th Century. Bermuda's fishing industry was largely subsistence fishing until after World War II. More regularized artisanal fishing dates from about 1945.[1] The fishermen were able to supply most of the local demand. One estimate indicated that during the 1950s and 60s, domestic fishermen supplied about two-thirds of local demand. Steadily expanding fishing effort during the 1970s began to strain the stocks of many demersal species that were targeted.[2] The number of fishermen declined by about half in the 1970s with little impact on the catch.[3] At the same time, an expanding tourist industry and growing population increased domestic demand. Bermuda fishermen by the 1980s were only able to supply one third of local demand.

The Bermudian fishing industry reported catches of over 820 t in 1987, but has since declined to little more than half that amount. There was a precipitous decline to 460 t in 1990 when the pot ban was introduced (appendix B1a). A catch of only 390 t was reported in 1993-94, but nearly 460 t was reported in 1997. The catch is largely composed of reef fish (snapper and grouper, wahoo and other carangids.) Fishermen also take small quantities of yellowfin tuna.

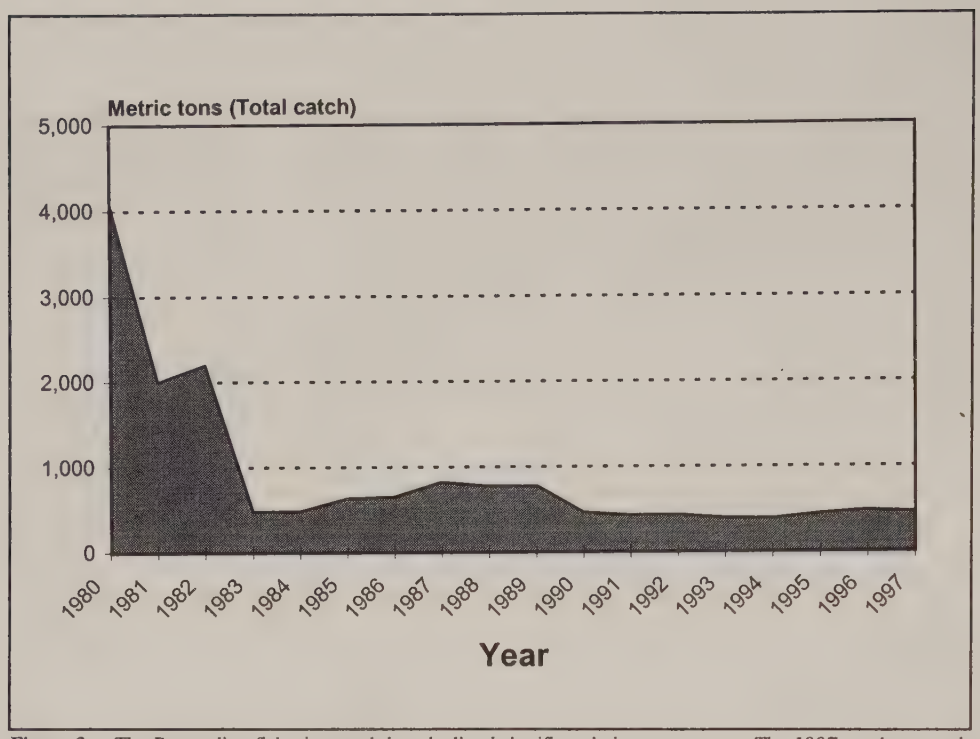

Figure 2.-- The Bermudian fisheries catch has declined significantly in recent years. The 1997 catch was only a fraction of catches during the 1980s.

The sharp decline in the overall fisheries catch obscures the full assessment of the situation faced by Bermudian fishermen. The catch of the preferred species such as snappers and groupers have fallen more precipitously than the overall catch. The catch of these species has declined to very low levels. They have only partially made up by increasing catches of other species, such as parrotfish, angelfish, and other herbivorous species. The catch has also been affected by pollution from an expanding urban production. The sewage caused especially large algae growths which have not been cropped as effectively because of the increasing harvest of herbivorous fish. The algae has caused a substantial degradation of Bermuda's coral reefs which has, in turn, adversely affected populations of reef fish.[4]

Bermuda in 2000 had about 220 licensed full-time fishermen. The Fisheries Division (FD) reported that in 1999 there were about 190 licensed fishing boats, about 145 of which were suitable for off shore commercial fishing.[5] Industry sources say, however, that the official statistics inflate the number of active fishermen and vessels. Some fishermen register their vessels and only fish occasionally. A commercial registration allows them to sell the fish that they catch, even on a recreational trip.[6]

The Bermuda fishery once relied heavily on pot (trap) fishing. The fishermen used a standard Antillian wire fish pot. The pot fishery, as on many Caribbean islands, dominated the local fishing industry during the 1970s and 80s. A small number of licensed charter boat and commercial line fishermen targeted pelagic species like tuna, wahoo (*Acanthocybium solandri*), and amberjack. Some interest in marlin also developed, stimulated in part by the organization of an annual billfish tournament in 1974.[7]

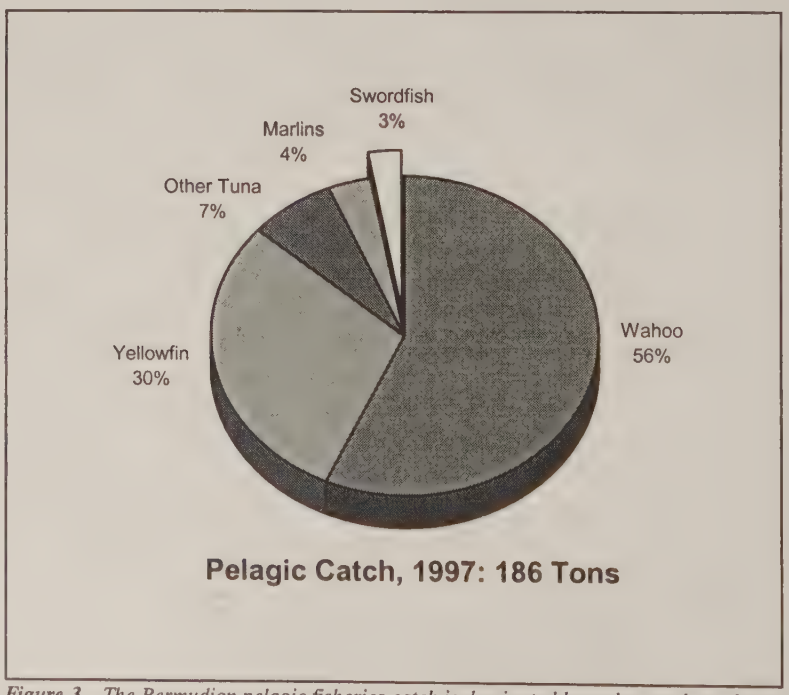

Figure 3.--The Bermudian pelagic fisheries catch is dominated by wahoo and to a lesser extent yellowfin tuna.

Continuing declines in the heavily fished stocks of inshore demersal species caused the Government to ban pot fishing in 1990. This necessitated a major adjustment for Bermudian fishermen who had to buy new fishing gear and learn new methods. Most of the fishermen shifted to chumming, trolling, and handlining. Bermuda's fishery has become a largely pelagic fishery with wahoo, since the mid-1980s, becoming the most important species. Landings peaked in 1996.[8] Some illegal pot fishing continues, but fisheries enforcement officials are very strict and impound the boat and jail the fishermen when pots are found aboard fishing boats.[9] The demersal fishery (bonito, grouper, and snapper) is conducted year round. The pelagic fishery (wahoo, dorado, and tuna) is highly seasonal. Fishermen report the best catches in May and September.[10] Most of the important wahoo catch is normally taken in the second and third quarters of the year.[11]

The character of the Bermuda fishing industry changed significantly during the 1990s. Many younger people are not entering the commercial fishery, but rather have begun to offer charter boat services for recreational fishing. The fishermen not only receive good fees from the anglers, but are able to profit from the sale of the catch as well. Even some long established fishermen are considering a shift to charter boat operations.[12] The marlin fishery which began to develop in the 1970s has, as a result of the work of a strong conservation movement, become a catch and release fishery.[13]

Some observes believe that the pot ban had an important impact on the environmental movement on Bermuda. One Caribbean observer insists that the Bermuda net and fish trap ban was truly an example of an management action to protect declining fishery resources. That action however, forced the fishers and other resource users to develop alternative non-extractive economic benefits from the resources that was previously exploited.[14]

Bermuda fishermen do not export appreciable quantities of seafood (Caribbean overview, appendix F1b). Exports are sometimes reported for Bermuda, but this is primarily product transshipped by foreign fishermen. Most Bermuda exports have been shipped to the United States. U.S. trade data occasionally shows small shipments of crab or live turtles which are Bermuda-caught product. Larger shipments of tuna and other species, including swordfish, have mostly been transshipped by foreign fishermen (appendix F2d). Some large export shipments were reported in the 1980s to other countries, but these were transshipments. Japanese fishermen used Bermuda extensively as a transshipment point during the 1970s (appendix C). Bermuda imported an estimated $7.2 million worth of fishery products in 1997 (Caribbean Overview, appendix F1a). Import shipments in the 1990s have ranged $5.7 million (1996) to $9.8 million (1992). These shipments are largely fresh and frozen fish and shellfish, much of it to supply hotels and restaurants catering to the tourist trade.

Bermuda has some potential for developing fisheries targeting oceanic species such as swordfish and tunas. The interest of foreign fishermen (Canada, Taiwan, the United States, and others) demonstrates that there is commercial potential. The local fishermen, however, have no experience with the necessary longline fisheries technology. Investors are reluctant to commit the needed investment in longliners and gear and equipment for unknown returns. Nor is it clear that Bermudians would want to work on such fishing vessels.[15] As a result the island's pelagic fishery resources have not yet been developed.

II. Species

A. Spawning

The spawning grounds for swordfish are primarily deduced by the location and abundance of swordfish. One 1983 study reported that there is relatively little spawning within the Caribbean. Most of it occurs north of western Cuba in the Gulf of Mexico. Significant concentrations of small larvae have been found there. Notably this is an area from which larval swordfish can be transported by the Gulf Stream into the western Gulf and Mexico and north along the U.S. eastern coast to Cape Hatteras--the northern limit for significant concentrations of larval swordfish. The larvae have been found in the area of the Gulf Stream and along the continental slope. The larger larvae found off Hatteras close to the U.S. coast may well be from fish spawning in the Florida Straits. Swordfish do not appear to spawn in Bermuda waters. At least the results from a small number of sampling stations have shown no swordfish larvae to be present. While Bermuda is located at latitudes south of Cape Hatteras, larvae have not been reported east of about 85°W, an area well to the west of Bermuda (65°W).[16] A 1998 study reported similar results.[17]

B. Migrations

Tagging studies suggest that swordfish migrate north and south along the Gulf Stream to the west of Bermuda. They also appear to follow the north Atlantic Gyre to the north and west of Bermuda (Caribbean Overview, appendix C3). A fuller discussion of the tagging data and graphics are available in the Caribbean Overview of this report. Foreign fishing data confirm that swordfish are found in Bermuda waters. There was one swordfish tagged in the Gulf of Mexico that moved into waters north of Bermuda (tag number R039927). The larger populations, however, probably move around Bermuda in the Gulf Stream and north Atlantic Gyre. Confirmation of this will only be possible when data from the new archival tags becomes available.

C. Other

A book on Bermuda fishing included a photograph of a 20 kg swordfish that had grounded itself on a beach. The swordfish was apparently so intent on following a prey item that it stranded itself.[18]

Photo 2.--This swordfish was so intent on pursuing its prey that it ran up on to a Bermuda beach. Bermuda Trade Development Board

III. Fishing Grounds

A. Oceanography

Bermuda is located at 32°N and 64°W, well north of the Caribbean and off the coast of North Carolina in the United States, the islands closest neighbor. The island is in effect located near the center of the north Atlantic subtropical gyre. The Gulf Stream, about 450 km to the west and north, transports vast quantities of warm Caribbean water north. While well west of Bermuda, this transport of warm water has a major impact on the Bermuda climate. Much more dispersed ocean currents to the east of the island circulate water back south to tropical latitudes. The wind regime increases in velocity from December to April.

Bermuda is located in the northwestern area of the western Atlantic's Sargasso Sea. This Sea is bounded by the Gulf Stream to the northwest and the Canaries Counter Current to the southeast which form the north Atlantic Subtropical Gyre. This gyre turns in a clockwise motion over a large area of the western north Atlantic, trapping sargassum seaweed (from which it gets its name) as well as large quantities of driftwood and plastic and other debris. A variety of marine species such as dorado, jacks, eels, and flying fish breed or lay eggs in this unique marine ecosystem. Juvenile billfish are also found there. Juvenile sea turtles feed and mature in the Sargasso Sea.

Sea surface temperatures off Bermuda vary seasonally. Given the more northerly latitudes, the seasonal temperature range is much greater than those experienced by the Caribbean islands to the south. Temperatures can vary from 17°C in February to 28°C in August. A thick layer of 18°C water extends from the surface to about 450 m around the Bermuda Rise. It prevents offshore surface waters from penetrating closer and further cooling Bermuda coastal waters. A permanent thermocline exists below 450 meters. Water temperatures fall to 10°C at 800 meters.[19]

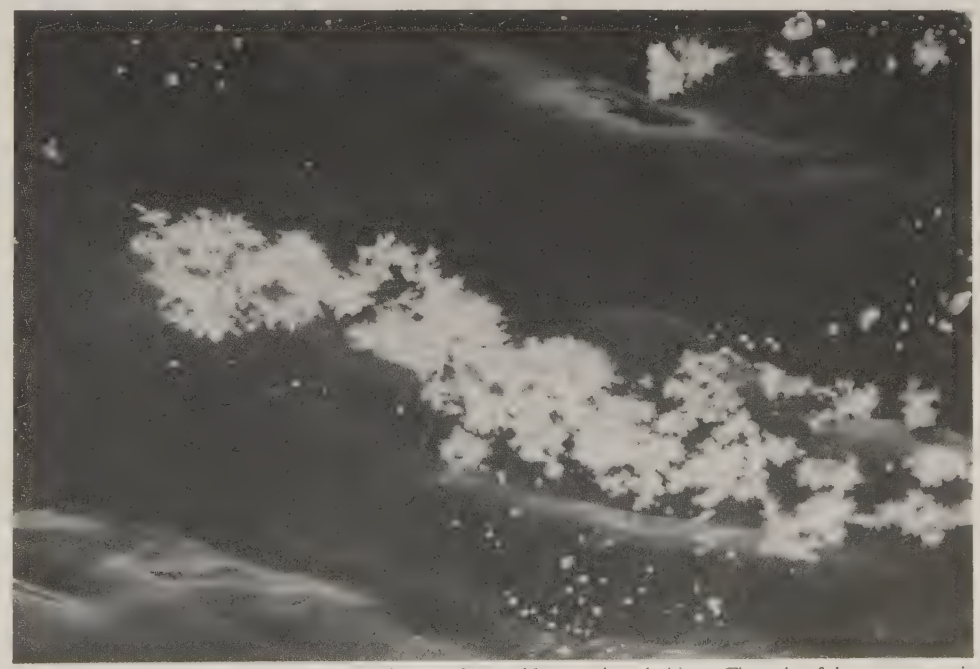

Photo 3.--The Sargasso Sea to the south of Bermuda provides a unique habitat. The role of the sargassum in the life history of species like swordfish is not well understood. Larry Settle

Several oceanographic factors have a strong impact on Bermudian fisheries. The western area of the Bermuda Exclusive Fishing Zone (EFZ) is strongly influenced by the Gulf Stream. While the major flow of the Gulf Stream is along the U.S. coast, the influence is felt in the Bermudian EFZ and eddies from the Stream reach the EFZ. Water temperatures around Bermuda, as a result, or much higher than would normally be the case at that latitude. Such eddy currents can be rewarding features in which to set longlines. Close to Bermuda itself there is some upwelling as is often the case with isolated oceanic islands. Such upwelling can support fodder species which in turn attract oceanic pelagics.

Swordfish are strongly associated with the Gulf Stream and continental slope to the west of Bermuda. Some swordfish which seasonally move north along the Gulf Stream to rich northerly feeding grounds off New England and Canada, return south by retracing their path along the Gulf Stream. Other individuals appear to follow the more dispersed Subtropical Gyre south back to Caribbean waters. These fish pass through Bermudian waters and waters to the east of Bermuda.[20]

The current strength around Bermuda is relatively weak. Average surface speeds of less than 0.5 knots are reported. Directions of the currents are highly

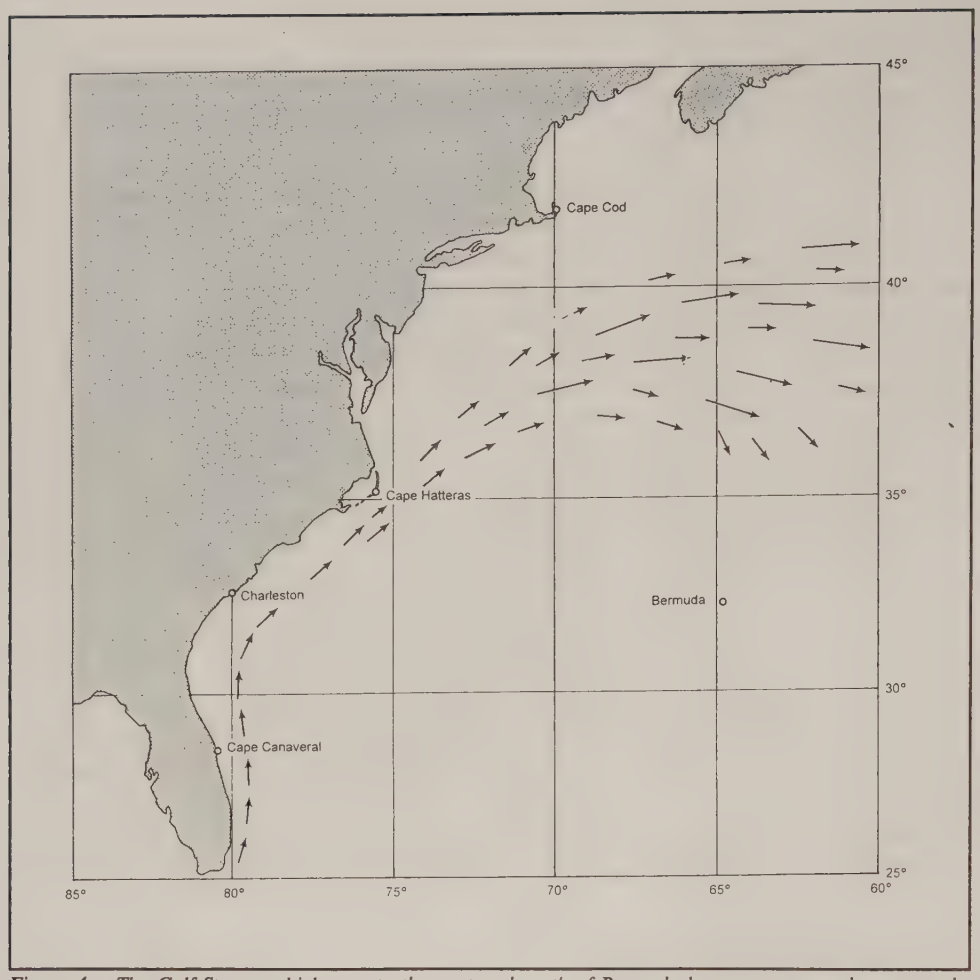

Figure 4.-- The Gulf Stream which runs to the west and north of Bermuda has an enormous impact on the islands' climate. Smith-Vaniz, Collette, Luckhurst.

variable. Bermuda is influence by the mid-Atlantic or "Bermuda High". Extra-tropical storms can occur during the winter season (November-March). In the summer (May-October), few extra-tropical storms reach Bermuda. Tropical storms generally occur between late August and October. Usually at least one storm a year approaches Bermuda and the island is struck at least every 4-5 years by a hurricane-force storm.[21]

The nutrient content of the water surrounding Bermuda is relatively low. Nutrient levels do increase as you move shoreward. Several oceanographic processes work to conserve nutrients on the Bermuda platform.

B. Topography

Bermuda, although referred to as a single island, is in fact an archipelago consisting of seven main islands and many smaller islands and islets. The Bermuda platform, often called the Bermuda rise, forms an atoll. The islands and reefs surround a central shallow lagoon. There are about 100 closely linked islands, covering about 50 square kilometers. Bermuda is a densely populated low-limestone island of coral formation.

The archipelago is the summit of a submerged volcanic mountain range which was formed from eruptions along the mid-Atlantic Ridge. The volcano has been extinct since before the first ice age. Layered over the volcanic foundation is a thin layer of sandy soil capping a 60 m layer of limestone. The coral deposits in the limestone justify Bermuda's description as a "coral island," however, it is more accurately described as a mixed superstructure of aeolian petrified sand hills and limestone upon an eroded volcanic base. Only the offshore reefs are true coral structures. While low lying, the terrain is hilly. There are no mountains, but hills reach 80 m above sea-level. The northern coast is very rocky with wind-carved cliffs.

The Bermuda Platform or Rise which provides a small shelf area. The platform is located on the southeastern rim of a seamount. There are numerous fishing banks around Bermuda, covering about 1,000 square km, substantially exceeding the actual land area. Two submerged volcanic peaks to the southwest, Challenger and Argus Banks, both with water about 50 m deep, are of particular importance to the local fishermen (figure 5). Beyond the platform, the slope falls off sharply to almost 4,600 meters. The platform is fringed by coral reefs which are located 12 km from shore to the west and about 1 km to the south. Bermuda is the most northerly location that reef-building coral can be found. This is another impact of the warm ocean regime influenced by the Gulf Stream.

The waters around Bermuda have been the subject of a great deal of oceanographic research because of the island's unique location. Acoustic transmissions from Bermuda have been used to estimate the position of the Gulf Stream in real time. The information derived can be used to improve estimates of Gulf Stream frontal location derived from infrared satellite imagery.[22] Some studies have shown that mean sea-level around Bermuda has been rising at an alarming rate, a potentially devastating long-term trend. The most apparent impact of this is the retreat of mangroves with the erosion of peat around the root structure, causing the mangroves to be highly susceptible to windthrow. High losses of leaf litter make it impossible for peat to buildup that would allow the mangroves to keep pace with sea level rise. Beach erosion and sand deposition on sea-grass beds is another problem. Bermuda has an active coastal conservation and research program which serves as an example to other islands, many at tropical latitudes, on how to respond to the sea-level rise threat.[23]

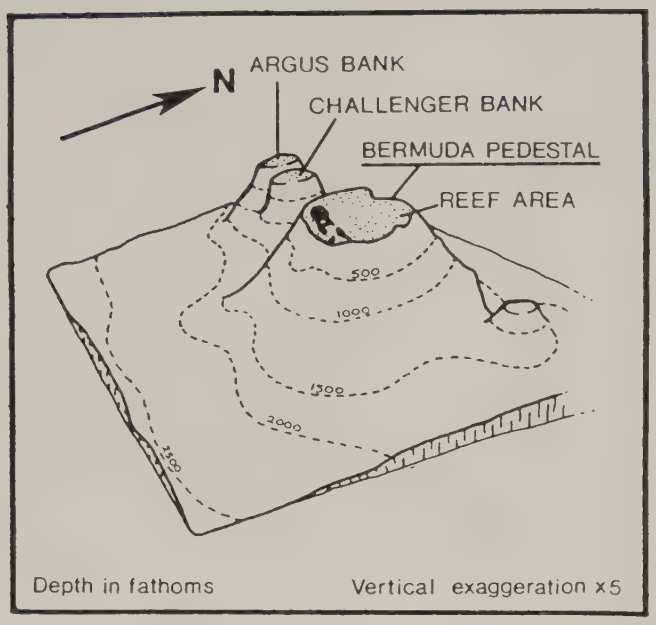

Figure 5.-- Bermuda sets on a pedestal and the important Argus, and Challenger banks on separate outcroppings to the east. James and Schenk

C. Fishing grounds

The domestic fishermen almost exclusively target demersal and near-shore pelagics located on Bermuda's 500 square kilometers (km) shelf and two adjacent shallow-water banks lying 25-40 km southwest of the main island, the Argus and Challenger Banks.[24] Most of the catch is taken close to the main island, within 20-40 kilometers.[25] Fishermen with the largest boats tend to focus on the Argus Bank. As it is further out, many fishermen with small boats do not fish there and it is thus less heavily fished than the inshore grounds.[26]

Bermuda officials have concluded that while the island's 200-mile Exclusive Fishing Zone (EEZ) are not generally regarded as the most productive in terms of fisheries production, the EEZ with its 400-mile diameter in the mid-Atlantic could support a well-directed highseas fishery. Officials indicate that to date, the small number of Bermuda fishermen which have launched operations have achieved respectable catches of swordfish and tuna and "... these can be expected to increase with additional experience and effort".[27]

Bermuda officials are currently assessing how to best use their EEZ. There is considerable difference of opinion within the fishing industry. Artisanal fishermen are fearful that longlining will impair their operations. Recreational fishermen are concerned that longlining will reduce billfish stocks. Even among those interested in investing in longlining and union representatives there are differences as to whether longlining should be conducted solely by Bermuda fishermen or rather, at least initially, there are advantages to leasing foreign longliners. Some environmental and civic groups question whether any type of fishing, except artisanal fishing, should be conducted in the EEZ and are promoting the establishment of a marine preserve.[28] (See "Government Policy: Development options".)

The best fishing grounds for swordfish off Bermuda are not fully understood at this time. Some data from fishing operations offer limited insights. Productive grounds for swordfish and other large pelagics may vary substantially on both a seasonal and annual basis. It is likely that seasonal and annual fluctuations of the Gulf Stream track and associated eddies have a substantial impact on fishing results off Bermuda, especially to the west of the island. The most extensive data set is that compiled by Japanese and the other Asian longline fishermen. That data is, however of only limited utility because swordfish was not the target and effort data is not readily available.
Bermuda: The authors have little information on the grounds targeted by the domestic Bermuda fishermen. As their longline operations are still quite limited, the fishermen are probably still assessing potential grounds. One report suggests that Bermuda's most active longliner in 2000 was targeting swordfish, primarily setting off the Challenger Bank west of the island.[29]

western reaches of the Bermuda EEZ may vary significantly.

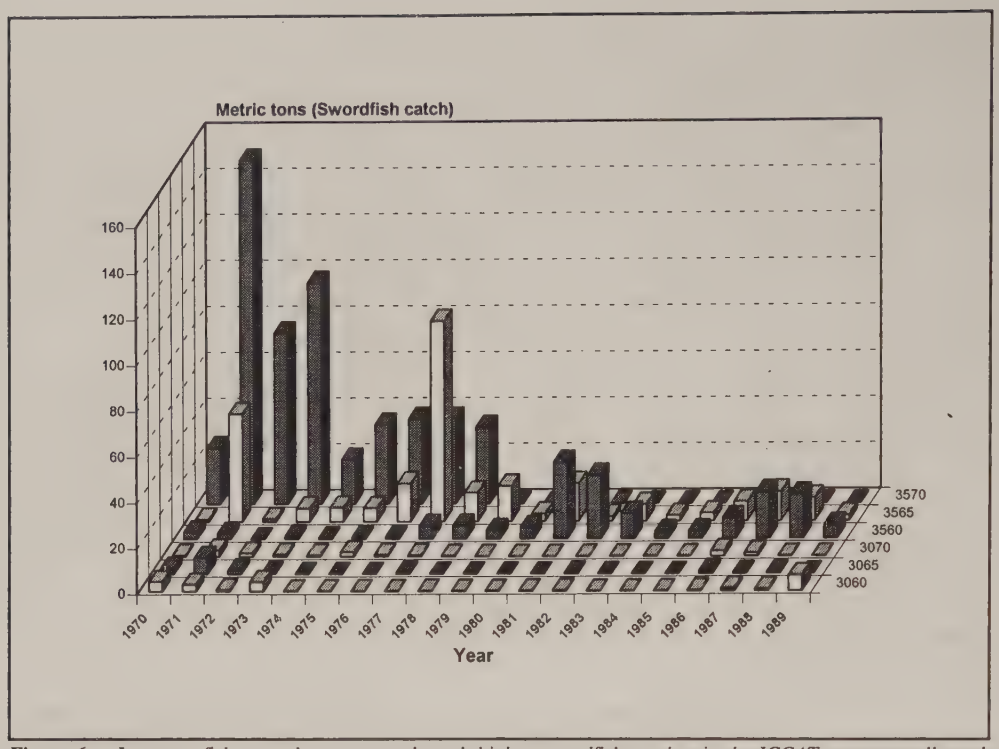

Figure 6.-- Japanese fishermen have reported much higher swordfish catches in the ICCAT squares well north of Bermuda (north of 35°N) than the areas immediately around Bermuda (north of 30°N).

Japan: Japanese fishermen have reported swordfish catches in all the ICCAT 5° squares around Bermuda.[30] The catches immediately around Bermuda, however, have been limited in comparison to some of the 5° squares north of Bermuda (appendix D1b). The authors stress that as mentioned above, swordfish was not the target species and effort data needs to be assessed to fully interpret the available catch data. Even though they were not targeting swordfish, in one quarter the Japanese caught over 100 t of swordfish in ICCAT square 3570 northwest of Bermuda--a phenomenal quantity.

Korea: Only limited Korean fishing was reported around Bermuda. The best catches appear to have been in the ICCAT 5° 3060 square around the island, but good catches were also reported west of the island in the 3065 square (appendix D1a). Unlike the Japanese, the Koreans have not fished extensively to the north of Bermuda.

Taiwan: Taiwan fishermen have reported small catches around the island. Like the Koreans, they have not fished extensively to the north (appendix D1c). The largest Taiwan catch was reported west of Bermuda in ICCAT square 3065 where they took nearly 22 t of swordfish in one quarter.

United States: The U.S. longline fishery is conducted primarily to the west of Bermuda along the Gulf Stream and associated eddies and the slope of the continental shelf. As the Gulf Stream track and eddies varies seasonally from year to year, fishing in the

Photo 4.--The "Kesi" is a typical small Bermuda artisanal fishing boat. Dan Hellin

IV. Fleet

A. Domestic vessels

Officials report that the Bermuda fishing fleet consisted of 194 vessels in 1997, about one-third of which targeted tuna or tuna-like species.[31] Bermuda fishing vessels range from small outboard-powered "Boston-whaler" boats to commercial vessels of about 45 meters (m). Most boats are about 10-12 m in length with 200-240 hp motors. The larger vessels have wooden hulls sheathed with fiberglass. Many of the older wooden vessels are being phased out with fiberglass boats. Many of the newest vessels are entirely of fiberglass construction. Flying bridges, providing needed visibility when navigating on the reefs, are common.[32] A typical vessel is the 10-m *Scorpion III*. It is a fiberglass vessel used for trawling and handline operations. It has a 225 kilogram (kg) ice hold. The vessel is capable of reaching the main offshore fishing banks (Argus and Challenger) about 25-40 km south west of Bermuda. It has a 200 hp inboard motor.[33]

A few Bermudian fishermen are attempting to work with longliners. The authors, however, have been able to obtain only limited information. A Government report in 1997 indicated that purpose built longliners have been acquired and one company has leased a longliner, but provided few additional details.[34] Bermuda reports to ICCAT indicate that two small longliners were active in 1996 and 1997 (appendix A2a). More current data is not available from the DF.[35] Recreational fisherman reports that as of 2000 there were three small longliners operated by Bermuda companies. The cost of purchasing and rigging a longliner as well as the technical knowledge required has prevented many local fishermen from entering

Photo 5.--Seamont Fisheries leased the Canadian longliner "Alexis" for operations during 1996-98. It was an older vessel and while reporting good catches was expensive to maintain. N. Inchcup

the fishery. There are a few Bermudian fishermen, however, who have entered the fishery.[36]

The authors have been able to obtain the following information on Bermudian longliners.

Domestic longliners: Bermudian fishermen have deployed four small longliners during the 1990s. Officials report that in 2000 there were three vessels suitably geared for pelagic, but only two that were active.[37] One company is actively attempting to purchase another longliner. The currently active longliners are the 21-m steel hull *Ark Angel*, the island's largest longliner, and the 16-m GRP *Trilogy* (appendix A2b). The *Ark Angel* has been active since 1996 and the *Trilogy* since 1994.[38]

Leased longliners: The Bermuda company Seamont Fisheries has contracted for two foreign longliners. The first was the Canadian longliner *Alexis I* which worked out of Bermuda during 1995-98. It was an older vessel and considerable difficulty was encountered with maintenance. Seamont also chartered the 38-m steel hulled *Jurel*. The *Jurel* operated out of Bermuda from late 1998 to mid 1999. It was leased from the Flota Atunera de Cuba (FAC).[39]

B. Flag-of-convenience vessels

Bermuda reported no domestic longliners to ICCAT in its fishing fleet until about 1994 (appendix A2a). Actual operations, however, may have begun a few years earlier. Industry sources, however, reported as small longliner as early as 1993.[40] Some foreign fishing vessel owners have registered their vessels in Bermuda. This has included tuna longliners. Some tunas purse seiners have also occasionally been registered in Bermuda (appendix A3).[41] Lloyds Register reports a few large fishing vessels were registered in Bermuda during the 1990s (appendix A4). These vessels are probably owned an operated by foreign concerns. While most of the flag-of-convenience vessels are believed to operate primarily in the Atlantic, some of the vessels (such as the *Torro Bravo*) were deployed in the eastern Pacific.[42]

Officials from various international organizations (FAO, ICCAT, and the UN) have made Bermudian officials in recent years aware of the problems created through these flag-of-convenience registrations.[43] Fishing vessels were only a small part of the Bermuda ship registry. Given the importance of the registry to Bermuda and the problems encountered with fishing vessels, officials decided to stop registering foreign fishing vessels.[44] This is in sharp contrast to some Caribbean islands, especially St. Vincent, which have registered substantial numbers of foreign fishing vessels.

C. Recreational vessels

The Bermuda billfish recreational fleet consists of approximately 20-25 licensed charter boats and about 50 private boats. These vessels are primarily fiberglass vessels ranging from 5.5-20.0 m in length, averaging about 11.0 meters.[45] A typical Bermuda recreational vessel is the 8-m, fiberglass *Tango* used for both recreational and commercial fishing, primarily demersal species and migratory species like wahoo, yellowfin, and blackfin.[46] One of the largest sport fishing boats is the 16-m *Mako 4* which can run at 30 knots and has set several Bermuda sport fishing records, such as a 613 kg blue marlin.[47] Some vessels such as the 20-m *Eureka* are even larger.

D. Foreign vessels

Photo 6.-- Boating is a popular pastime in Bermuda and there are large numbers of recreational boats. Many of the owners enjoy recreational fishing. Dan Hellin.

The foreign vessels licensed by Bermuda have generally been the standard longliners deployed by Korean, Japanese, and Taiwan fishing companies. While numbers of trawlers called at Bermuda to transship their catch, the authors know of no licenses purchased for these vessels.

Faroe Islands: The Faroese deployed side trawlers of about 400 GRT. They were modified in 1979 and licensed for longlining. They deployed a continuous longline.[48]

Japan: Japanese longliners have been the most active around Bermuda and in waters north of Bermuda. The authors have no

Photo 7.--Most of the Bermuda licenses issued to foreign fishermen were issued to Taiwan longliners working under contract to the Japanese Nicherei company. Dennis Weidner

details on the specific vessels deployed, but the Japanese fleet is described in the Japanese chapter of this report.[49]

Korea: The Korean vessels deployed in the late 1970s were about 250 GRT and carried crews of approximately 25 men. They used the basket longline system.[50]

Taiwan: Large numbers of Taiwan longliners were deployed seasonally in the north Atlantic around Bermuda in the 1980s. The Taiwan vessels were similar to those deployed by the Koreans.

V. Shipyards

Bermuda has no large industrial shipyards capable of building or maintaining large fishing vessels like a modern commercial longliner. There are several yards which service the substantial fleet of smaller recreational boats that are based in Bermuda or frequent the island. There is considerable competition among these yards. The Bermudian yards service wooden hulled vessels (averaging about 8-9 m) and fiberglass hulls (mostly 7.5-12.0 m). Larger boats are beyond the capacity of the Bermuda yards and the fishermen often take them back to the U.S. shipyards where they were purchased.[51]

Mills Creek Marine: The Mill Creek Marine yard is located in Penbroke.

North Basin Yard: See West End Yachts.

Offshore Yachting and Maintenance: Offshore Yachting, formerly Red Hole Boat Yard, was established during 1989 in Hamilton Harbour. It is the parent company for West End Yachts located at Ireland Island. They perform all kinds of repair for fiberglass yachts and sport fishing vessel and a declining number of wooden boats. They also do engine repairs. The boats they service average about 10.5 m in length and are small boats used for inshore reef fishing, tourist cruisers, and pleasure boats. Offshore Yachting has three cradles and docking spaces for 4-5 boats being repaired.[52]

SPAR Yard Industries: This yard is located in Sommerset Bridge.

St. George's Boat Yard: This yard has operated in St. George's since 1990. It works on boats with either fiberglass and aluminum hulls. They also work on a few wooden vessels, mostly owned by clients that have contracted services for several years. This yard conducts a variety of services including painting and small repairs. Needed engine and equipment work is contracted out. Operations are highly seasonal, with most boat owners wanting maintenance work done from January to May. They work on vessels up to 35 GRT. They also have a small marina for recreational boats which operates seasonally.[53]

West End Yachts: West End, formerly North Basin Yard, is a subsidiary of Offshore Yachting and Maintenance which purchased it in 1988. It is located at Ireland Island. They perform all types of repairs. They have their own shops for both vessel and engine repair. They specialize in insurance repair, meaning vessels that have hit reefs or sustained other damage and are being repaired under insurance coverage. Company spokesmen say that such incidents are common because there are so many reefs around Bermuda.

Most of the motors they work on are 200-300 hp, but they can also work on smaller outboard motors. The yard operates all year round, but November to January is a slow season. It is a large yard, capable of working on over 100 recreational boats at any given time. There are no marina facilities.[54]

There is very little boat construction on Bermuda. Both recreational and commercial fishing boats are

imported. Many of the commercial fishing boats are imported from U.S. shipyards.[55] The larger commercial boats (over 15 m) imported by Bermudian fishermen are generally serviced in U.S. shipyards.[56] While large commercial longliners are not repaired in Bermuda, one local observer reports that in 1999-2000 a large (about 25 m) commercial fishing vessel, the *Ark Angel*, has been moored at Ireland Island.[57]

VI. Fleet Operations and Gear

A. Commercial fleet

Bermuda fishermen primarily target inshore species like grouper which are in great demand in the local market. Fishermen have used a variety of methods, including traps, trolls, handlines, nets, and some longlines. Traps targeting reef fish were traditionally the most commonly used gear.[58] The popular inshore reef species, however, were heavily fished and the Government attempted to reduce fishing effort by buying out the inshore licenses. Conservationist and tourism industry groups criticize the domestic fishermen for over fishing and the Department of Agriculture and Fisheries (DAF) for not more strictly managing the resource. The United Bermuda Fishermen's Association blame foreign fishermen.[59] The DAF, increasingly concerned about demersal stocks, banned the use of traps in 1990 to protect the resource.[60] This was a major step because so many of the fishermen used traps. It was highly controversial at the time and court challenges continued for years with one Member of Parliament charging that the pot ban violated the Bermuda Constitution.[61] The DAF has also banned gillnets.

Bermuda fishermen made major changes in their operations during the 1990s. The pot ban forced the fishermen to give up fishing practices which they had used all their lives and adopt new methods with which they were less familiar. The fishermen now mostly troll or deploy hand lines. Many fishermen conduct both troll and handline fishing from the same boats. The handlines are used for targeting demersal species and the trolls are for pelagics. A typical trip is normally 1 day, especially when targeting demersal species.[62] Trips targeting pelagics can be up to 2 days.[63] Some fishermen remain devoted to trap fishing and illegal fishing continues 10 years after pots were banned.[64]

Photo 8.--The Canadian longliner "Alexis I" was the first longliner to be deployed by a Bermuda company. This photograph shows the box with the hook and leader lines. Seamont Fisheries

Bermuda fishermen still have little experience with offshore fisheries such as longline fishing for tuna and swordfish. Almost all fishing is conducted close to the island or on nearby banks to the west of the island. Nor are pelagic species traditional favorites among Bermuda consumers who were mostly familiar with the demersal fish landed by the pot fishermen. Because the fishermen have not heavily targeted pelagics in the past, consumers had little familiarity with these species. This has begun to change in Bermuda because troll fishermen now land substantial quantities of pelagics, especially wahoo and tuna--mostly yellowfin. Bermuda officials are encouraging local fishermen to further expand pelagic fisheries by initiating offshore fisheries using gear such as longlines, but offshore operations require larger boats and more technical knowledge.

Photo 9.--The large, commercial mainline reel of the "Alexix I," leased from Canadian fishermen, was housed in a protected area. Seamont Fisheries

Photo 10.--This photograph shows more of the gear used aboard the "Alexis I". Seamont Fisheries

Photo 11.--Fishermen on the "Alexis I" are landing their catch, in this case a small swordfish. The "High Flyer" radar reflector buoys can be seen in the foreground. Seamont Fisheries

As Bermudian fishermen have no experience with offshore fisheries, it is a difficult step to enter such an unfamiliar and demanding new fishery. As a result, such operations have been limited even though at least two longliners have been acquired. Some information is available on the fishing operations of the two domestic fishermen currently operating longliners.

Ark Angel: This 21-m longliner operates out of west Bermuda. During the fall they target swordfish, primarily off the Challenger Bank.[65] The vessel also takes tuna.

Trilogy: This 15-m longliner operates with a crew of three. Fishing trips are limited to 4-5 days to ensure that a high quality product is delivered. Grounds about 60-80 km northeast of Bermuda are usually targeted during the colder months. Swordfish and albacore can be taken year round, but the sizes are usually smaller during the warmer months. During the colder months swordfish are taken ranging from 45-115 kilograms. The owner has noted a decline in the size of the fish being taken. While swordfish are targeted, yellowfin and wahoo are also taken. The catch is gutted and bled at sea and then processed in port to the specifications of the local clients.[66]

Local observers note a variety of obstacles to successfully initiating longline operations. The fishery requires considerable expertise which is not available locally. Another major obstacle is the substantial investment in gear and a vessel. Fishing is a very traditional activity in Bermuda with fathers teaching sons. There are no technical training institutes specializing in fisheries that young people can attend. Few Bermudians are knowledgeable about longlining so fathers are unable to teach their sons. Many enterprising young Bermudians see more opportunity in less arduous and demanding sectors on shore.[67]

The DAF in the early-1990s initiated studies to assess the island's potential for longlining.[68] As a result a few Bermudians have attempted to enter the longline fishery.

1993: The first longliner, *Princess K*, was introduced into the Bermuda fishery in 1993. A few Canadian longliners operated out of Bermuda.

1994: A few Bermudian fishermen received some training aboard the seven Canadian longliners that were licensed in 1994. One company reportedly operated the *Cutlass*.[69]

1995: A businessman leased the longliner *Alexis I* from a Canadian owner and operated it with a Canadian crew (appendix A2b).[70]

1996: ICCAT reports that two fishermen acquired longliners in 1996 (appendix A2a). Two domestic longliners were active in 1996, *Ark Angel* and *Trilogy*.[71]

1997: ICCAT reported the same two longliners for Bermuda in 1997. The DF reported developing longline activity in 1997. Local longliners were targeting swordfish and tuna.[72]

***Photo 12.**--This yellowfin tuna is being weighed and will be sold domestically. Note that the Canadian fishermen have headed it. Tuna unlike swordfish is often not headed. Seamont Fisheries*

1998: Industry sources suggest that the initial longline fishermen were not achieving profitable operations.[73] Two domestic longliners were active, the *Ark Angel* and *Trilogy* (appendix A2b).[74] Recreational fishermen report seeing little actual longline fishing.[75] Local observers, however, do note a variety of obstacles on Barbados for individuals interested in initiating longline operations.[76] The Cuban longliner *Jurel* was leased from the Flota Atunera de Cuba by Bermudian businessman Neil Inchcup in early 1998, but operations were delayed until late 1998 because of the need to bring the vessel up to Bermudian standards and obtaining needed documents for the Cuban crew.[77] The first catches were landed in December 1998.[78]

1999: Few details are available on the current status of longlining in Bermuda. The DF reports it is unable to provide information on Bermudian longline activities without ministerial clearances.[79]Industry sources, however, report that the same two domestic Bermudian longliners were active seasonally (appendix A2b).[80] The Cuban longliner *Jurel*, from the Flota Atunera de Cuba operated in early 1999. It landed a catch of 13.6 t of tuna, swordfish, and shark at Ships's Wharf, St. David on January 6, 1999.[81] Seamont Fisheries which chartered the *Jurel* complained about the large quantities of shark that the vessel was landing. There was little market for this shark in Bermuda, except for the Makos.[82]

2000: The longline situation in Bermuda was little changed in 2000. Industry sources report that as of August, there were still two active longliners.[83] Although the lease for the Cuban longliner *Jurel* continued until June 2000, all the difficulties with work permits, repairs, and other problems only permitted 9 months of actual fishing operations.[84] The high level of shark landings were an especially difficult problem. The same company who arranged the *Jurel* lease is trying to purchase its own longline.[85]

B. Recreational fleet

Tourism is the main industry in Bermuda and sport fishing is an attraction of some interest. Bermuda was a major recreational fishing destination during the 1950s and while it is no longer a sport fishing hot spot, it still boasts some excellent recreational fishing opportunities. While the FD compiles data on Bermuda's commercial fishery, little research has been done on the recreational fishery.[86] The fishery is promoted by the Bermuda Sport Fishing Association. Most of the sport fishing fleet is based in Hamilton, but a few boats also operate from marinas to the east and west of Hamilton.[87] Many of the participants come from cruise ships calling at Bermuda and most charter boat captains either pick up the fishermen or provide easy instructions on how to get to the boats from their ships or hotels.

Sport fishing is conducted for both inshore and reef species, as well as a wide variety of offshore species. Sports fishing on Bermuda is conducted from several different locations, including St. George's, Flatts, Pembroke, and Somerset. The bait used is mostly ballyhoo, flyingfish, and mullet. Boats may run up to 6 lines, from 6-12 lb test.[88] Charter boat captains normally operate within 20 km of the coast, mostly during the day, but there are some night charters available as well. The day time, coastal orientation of the sport fishery is why swordfish, as in the Caribbean, are rarely taken by anglers. The offshore sports fishermen target tunas (yellowfin, blackfin, and skipjack), marlin (blue and white), wahoo, dorado, shark, mackerel, and a variety of other species. The fishermen never encounter swordfish, which are in deeper water during the day than those frequented by the sport fishermen.[89] Local fishermen say some of the world's best yellowfin fishing is available off Bermuda and excellent marlin fishing is

Photo 13.--Bermuda was a major recreational fishing site in the 1950s. This impressive wahoo was taken by Vice Admiral Sir John Eaton in a tournament, but was disqualified by a shark bite. BTDB

Photo 14.– Recreational fishing has become increasingly important in recent years as some of the artisanal fishermen have begun to operate charter boats. Dan Hellin. (Photos 14-16 are a panorama.)

also reported. The fishermen either troll or chum for the tuna if the seaweed is thick.[90] The yellowfin which appear on the banks off Bermuda through the summer are taken by trolling and chumming. Marlin (both blue and white) are also taken.[91] One sport fisherman reports that during the season he gets about four billfish strikes per day.[92] The large size of some of the blue marlins taken off Bermuda has attracted anglers. A large marlin (1,000 lb/454 kg) is normally taken at least once every 2 years.[93] The season usually extends from May to October.[94] The peak months for taking blue marlin is usually June/July and August.[95]

Bermuda's temperate climate means that the big-game sport fishery is highly seasonal. Many species move north and south with the changing Atlantic water temperatures. One enterprising charter operator offers a weekly fishing report for anglers.[96] The general seasonal pattern is:

April: Some anglers begin fishing in April with yellowfin and blackfin tuna, wahoo, and an occasional early billfish.

May: The sport fishing year begins in earnest during May. Local fishermen claim that Bermuda offers the best yellowfin fishing anywhere with fish usually ranging from 7-50 kilograms. In addition to the yellowfin, wahoo fishing is good and the season for blue and white marlins begins.

June-August: The best marlin fishing is reported from June to August. A detailed DAF report indicates that the peak season for blue marlin is usually July and August.[97] The wahoo fishing is also good. The biggest yellowfin are taken during this period. Other fish taken include bonito, rainbow runner, barracuda, amberjack, shark among others.

September-November: The best wahoo fishing is reported in this period, but some yellowfin and billfish are also taken.

December-March: Catches are mostly wahoo and tunas. The ocean conditions are normally rough, so there is less activity than during the rest of the year.[98]

Photo 15.--An extension of the panorama shows the large variety of pleasure boats that can be found throughout Bermuda. Dan Hellin.

Bermuda hosts several sports tournaments. The MOE reports that 20 tournaments were held in 1999 (appendix F). Few are now of international importance. The most important is the annual billfish tournament, the Seahorse Anglers Billfish Tournament, which has been held annually since 1974. It is a 4-day tournament, usually taking place during the last week in July.[99] The tournament is scheduled for the peak of the

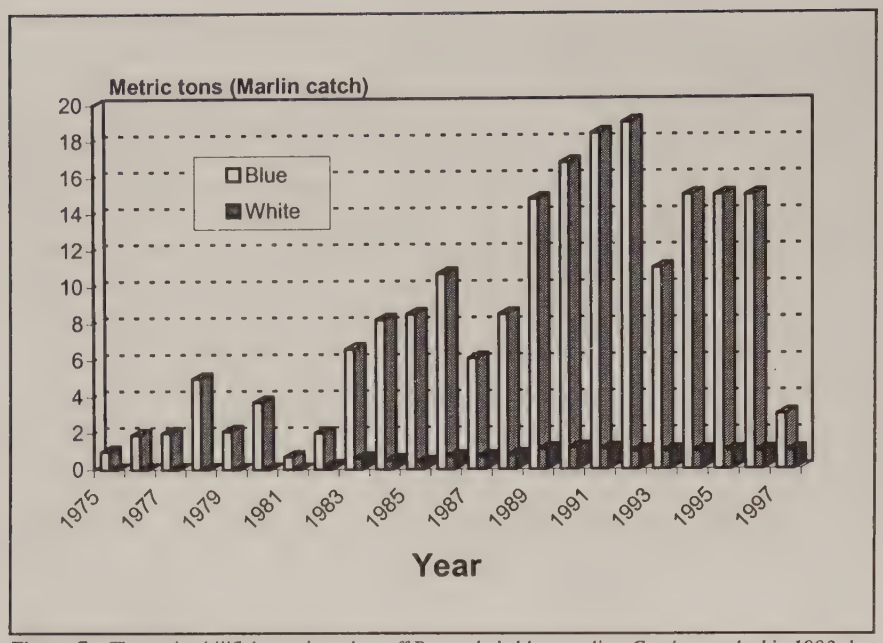

Figure 7.--The major billfish species taken off Bermuda is blue marlin. Catches peaked in 1993, but plummeted sharply in 1997.

marlin season. Blue marlin is the primary billfish taken, but some whites are also hooked. It is largely a tag and release tournament. Participants from 1992-98 boated only 9 marlin while releasing 125.[100] Some billfish is also caught in tournaments targeting other species.[101]

There are four major groups or boat clubs offering sport charters off Bermuda. One source indicated that about 20 charter boats or based in Bermuda.[102] A much larger number of anglers and boats, however, participate in recreational fishing. Some of the larger concerns are Bermuda Anglers, Blue Water Anglers, Seahorse Anglers, Spanish Point Boat Club, and Tam Marine. The associations or clubs offer charter boat services for fishing off Bermuda as well as organize trips to participate in Caribbean tournaments. There is considerable interest in billfish tournaments among the large number of individuals that have recreational boats in Bermuda, because they only have the one local tournament. Thus the clubs and charter groups organize participation in Caribbean tournaments.[103] Several of these clubs large boats (up to 35 m) which also offer sightseeing cruises. The clubs are composed of vessel owners conducting both recreational and commercial activities.

Bermuda Angler's Club: This is one of the larger clubs on Bermuda.

Seahorse Angler's Club: This is another of the large clubs with over 50 registered boats. About half the club's vessels are recreational vessels not used for fishing.[104]

Spanish Point Boat Club: This club began operations in 1947. There are 400-500 boat owners. The Spanish Point Club includes some fishermen, but many members are not fishermen, operating recreational sailboats and powerboats. Members pay $200 annual dues. The Club offers a variety of recreational activities, including fishing tournaments.[105]

Other clubs: The other clubs are smaller than those mentioned above, but are organized similarly.

The DAF encourages the world-wide "tag and release" program. The captains are mostly committed to tag and release fishing.[106] Most charter boat captain understand that when a fisherman gets the thrill of a lifetime in catching a huge billfish that he may want to take it home for stuffing and mounting. An angler chartering a boat should inquire in advance

Photo 16.-- An extension of the panorama shows, a large variety of pleasure boats can be found throughout Bermuda. Dan Hellin.

about a charter boat captain's policy. Many will let the fisherman take the catch home, in which case he can advise on who to consult for stuffing and mounting. Other captains feel the catch belongs to them.[107] A few anglers who failed to discuss this with the captain in advance have had unpleasant experiences. ICCAT reports that voluntary release programs have become increasingly common.[108] One of the fishermen reports that tag and release fishing is now the norm in Bermuda.[109] The DF confirms that release rates for marlin caught since 1992 has exceeded 80 percent and most were tagged.[110]

The DAF has a number of concerns with the current recreational fishery. The primary one is that there is no code of conduct concerning recreational fishing. Many charter boat operators essentially ask the their clientele to pay for the privilege of going commercial fishing. The captains see the catching of fish as their primary income and will not grant the charterer the choice of tackle or which species to see. Most captains will allow the charter to keep some of the catch for personal use, but some refuse to do even this. The MOE believes that "This is a sad commentary on an industry that was largely built on Bermuda's reputation as a light tackle paradise where the angling rather than the catching of a marketable commodity was the primary objective", There are in fact many inconsistencies as to how a charter captain treats his clients and, as a result, some tourists may be leaving Bermuda with "a less than pleasurable experience".[111] Bermuda officials believe that the recreational fishing industry as a whole has "a rather inflated view of itself," but in reality is not taking full advantage of the available potential because of the lack of a code of conduct and an inefficient marketing and promotional effort.[112]

Bermuda fishermen have provided the authors varying assessments of sport fishing trends. One fishermen credits the tag and release program with helping to maintain the stocks. He was grateful for NMFS's support of the program.[113] FD researchers report that an assessment of tournament results in the 1990s "has shown only small year to year variations with no clear trend".[114] One sport fishermen, however, complains that offshore longlining by foreign fishermen has so depleted the resource that it would not be productive to organize additional tournaments.[115] Available statistical data suggests substantial declines in marlin catches since 1997 (appendix B2b).

Many fishermen with small boats use them for both recreational and small-scale commercial fishing. One fisherman, for example, reported a particularly strong market for wahoo and grouper in early 2000. These fishermen will set up a make-shift stand by the landing point.[116]

C. Foreign vessels

Bermuda has licensed substantial numbers of foreign fishing vessels, mostly Asian longliners, to operate in its 200-mile EFZ. The numbers have declined significantly since the early 1990s as the Asian fleets have shifted away from albacore in temperate waters to bigeye in more tropical waters. A Bermuda company has in recent years leased two foreign longliners.

1. Licensing

Most of the foreign vessels obtaining licenses to fish off Bermuda are longliners which have to operate outside a 50-mile zone within Bermuda's 200-mile Exclusive Fishing Zone (EFZ). The foreign fishermen reportedly targeted albacore, bigeye, bluefin, shark, swordfish, and yellowfin.[117] Albacore were reportedly fished from December to March.[118] Foreign fishing within the EFZ has decreased significantly since Taiwan fishermen in the early 1990s shifted operations from albacore around Bermuda to bigeye in more tropical waters south of Bermuda.

Canada: Licenses were issued to a few Canadian swordfish longline fishermen in 1993 and 1994. Most of their operations were conducted in 1994. The Canadians were trying to fish above their country's ICCAT quota by operating from Bermuda. The catch was landed in Bermuda and exported to the United States (rather than Canada), but showed up as imports from Bermuda in U.S. trade statistics (appendix F2a1). The Canadian Government when it learned of this practice took action to prevent it.

Spain: The authors know of no Spanish purchases of Bermudian licenses. The Spanish longline fleet operates extensively in the mid-Atlantic, but not as far west as Bermuda (Caribbean Overview, appendix D6).

Taiwan: Taiwan longliners operating within and around Bermuda's 200-mile EEZ, as well as that of the Turks and Caicos Islands (TCI) to the south, reported a highly diverse catch, including large quantities of billfish. Data available for 1991 indicated that swordfish constituted about 11 percent of the catch which also consisted of marlin (30 percent), yellowfin (16 percent), albacore (15 percent), and other species (appendix B7).[119] The Taiwan fishermen in the early 1990s decided to refocus their fishery to bigeye and, as a result, shifted operations away from Bermuda to more tropical latitudes.[120]

United States: U.S. fishermen report little longline activity in the Atlantic off Bermuda. There is substantial effort to the west and north along the Gulf

Stream that runs along the U.S. coast, but little around Bermuda.[121] This is in part because a license is required for operations off Bermuda, but also because the U.S. longline fleet targeted swordfish and swordfish was not as plentiful in the Bermuda EFZ as it is along the continental slope and Gulf Stream along the U.S. coast. The authors have no information indicating that U.S. fishermen have purchased Bermuda licenses. Licensing data is not public information in Bermuda. The licensing data obtained by the authors is sketchy and a few U.S. fishermen may have obtained licenses (appendices D2a-b).

2. Leasing

The authors only know of one Bermuda company that has leased foreign longliners--Seamont Fisheries. This company has contacted two foreign longliners. In both cases, the vessels were operated by a foreign crew, but the registration was temporarily transferred to the Bermuda flag[122]. Seamont attempted to recruit local crew members, but encountered difficulty in finding interested workers.

A variety of rumors and accusations swirl around the longliners leased to operate out of Bermuda. The longliners, especially the Cuban *Jurel*, are larger than Bermudian fishing boats and thus attracted the attention of local fishermen and residents. As is the case in most countries, large longliners were not popular with the small-scale fishermen. Some believed that the vessels were buying fish in other countries rather than catching it off Bermuda. Wherever they acquired their catch, the local fishermen believed, with some justification, that the larger quantities landed were adversely affecting market prices. One rumor claimed that the longliners were landing demersal species (such as grouper) targeted by the small-scale fishermen. The authors can not substantiate such charges. One rumor reports a longliner was impounded by Bermudian fishery officials.[123] Local property owners have also complained about the presence of large, unsightly fishing vessels. The authors have attempted to contact FD officials to obtain definitive information on Government policy, but they were reluctant to provide information for public release on the Government's policy concerning leasing foreign longliners without ministerial authorization.[124]

Available information on the Bermudian leasing arrangements with foreign longliners include:

Canada (1996-98): The first foreign longliner leased by Seamont Fisheries was the Canadian longliner *Alexis I* which worked out of Bermuda during 1995-98. The *Alexis I* was operated with a Canadian crew. Seamont attempted to recruit Bermudians, but there was little interest. One Bermudian was found to serve as an engineer on the *Alexis I*. Seamont reports that the *Alexis I* operated successfully within the Bermudian 200-mile EFZ. Most of the catch, however, was taken close to the island, often within 20 km of shore. The *Alexis I* supplied substantial quantities of high quality fish. The catch included tunas (mostly albacore and yellowfin), swordfish, marlin, and wahoo (appendix B3a). Swordfish constituted 40-50 percent of the catch taken by the *Alexis I*. Some sharks were taken, but were not landed because there was no market for them on Bermuda. Most of the catch was marketed domestically. This fish allowed the company to build a substantial clientele on the island. Company representatives report that small quantities of swordfish and bluefin tuna were exported to the United States.[125] NMFS notes, however, that there were no records of Bermuda swordfish exports to the United States in 1996-98. Small quantities of bluefin (0.2 t) and yellowfin (0.9 t) were reported in 1997 (appendix F2c).[126] While Seamont was pleased with the quality of the landings, the *Alexis I* was quite old. Maintenance costs proved expensive and escalated in 1998.[127]

Photo 17.--Bermuda businessman Neil Inchcup reported good results leasing the Canadian longliner "Alexis I" from 1995-98. Semont Fisheries

Cuba (1998-2000): The second foreign longliner leased by Seamont Fisheries was the 60-m Cuban longliner *Jurel* which worked out of Bermuda during 1998-99. Faced with escalating maintenance costs with the *Alexis I*, Seamont executives looked for other alternatives and decided to contact the Cuban Flota Atunera de Cuba (FAC). Seamont and FAC reached agreement on leasing the commercial longliner *Jurel* out of Bermuda[128]. Seamont representatives were initially impressed with the efficiency and work ethic of the 26-man Cuban crew although they complained that the *Jurel* was a real "rust bucket" which was also costly to maintain and service[129]. The Bermuda Government granted Seamont a provisional fishing license.[130] The *Jurel* arrived in Bermuda on October 27, 1998, but was forced to return to Cuba to obtain updated documents needed for the crew's Bermuda work permits. This according to Mr. Inchcup, proved to be a continuing problem. Inchcup later complained of the "humiliating treatment" accorded the Cubans by Bermuda officials. He compared this with the respect shown him by Cuban officials while negotiating the lease arrangements.[131] Later Mr. Inchcup reported greater difficulty contacting Cuban FAC officials. Inchcup tried to recruit a Bermudian crew, but says the prospective crew members "hung up on him" when he explained that trips may be as long as 2 months. The Bermudian fishermen also did not like the idea of working at night.[132] The initial lease extended from October 1998 to December 1999, but because of complications over work permits, repairs, and other matters, only 8 months of actual fishing took place.[133] The *Jurel* deployed a 65-km line. The vessel conducted fishing trips varying from 1-2 months and landed swordfish, tuna, billfish, dorado and sharks. Swordfish was a small part of the overall catch, about 5 percent. Sharks were the larger part of the catch, about 12-13 percent. Seamont did not want shark to be a larger portion of the desirable catch (appendix B3b). The *Jurel* was allowed to fish in Bermuda's 200-mile EEZ, but also operated on the highseas.[134] The authors have no details on the contractual relationship, but Seamont reported that the cost of repairing and maintaining the *Jurel* eventually exceeded what it would cost to purchase a new vessel.[135] Even more frustrating was the fact that after the initial trip the captain of the Jurel kept landing large quantities of sharks rather than the species Seamont requested. Unlike most of the other foreign vessels licensed by Bermuda, the Cuban longliner reportedly landed its catch in Bermuda for sale on the St. George's market.[136] The first landings were reported

Photo 18.--A Bermuda engineer helps land part of the large shark catch taken by the leased Cuban longliner "Jurel". Royal Gazette

November 1998 and continued until June 1999.[137] The initial catch included albacore, yellowfin, swordfish, billfish, and other species--including very large quantities of shark (appendix B3b).[138] The Cuban captain continued landing large quantities of shark which Seamont could not sell. The Cuban captain was apparently extremely effective at catching shark, but was not familiar with the demands of a market economy where consumer preferences are of some significance.[139] Possibly the captain and crew were motivated by the value of shark fins.[140] The captain returned in April 1999 with a catch of 7.4 t, only 0.3 t of which was swordfish. The shark catch, however, was 3.7 t or 50 percent of the overall catch (appendix B6b). Seamont executives were stunned at the captain's ignoring their instructions, but reluctantly accepted the fish. The shark percentage, while large, was less than previously landed although still much more than Seamont could market. As expected, Seamont experienced great problems attempting to sell the shark, except for the makos, on the Bermudian market. Seamont at that time told the Cuban captain that they could simply not accept any more shark. Despite these instructions, in June 1999 the *Jurel* returned with more shark. The captain returned with a catch of 41.2 t, of which 34.0 t or over 80 percent was shark. Seamont was forced to refuse to accept the catch. The captain had to either dump it or take it back to Cuba. At the time *Jurel* was scheduled to return to Havana for maintenance and repairs--so the captain took the entire catch back to Cuba.[141] In the meantime local fishermen and residents in the area where the longliner moored complained to the Government about the large Cuban longliner. One resident told reporters, "The boat looks a wreck. We're not Haiti or Jamaica and we have a very respectable fishing fleet of our own."[142] There was some support within the Government for the Seamont-FAC contract. Ministry of Environment officials have reportedly been encouraging the company to enter the longline fishery, hopefully as a prototype for other such operations.[143] Seamont continued to pursue the contract with the FAC. When the *Jurel* did not return from the scheduled maintenance, Seamont contacted FAC officials and was told the captain had been fired and so the *Jurel* could not return as anticipated. Seamont then arranged with the Government to extend the lease to June 2000. Seamont reports, however, that they never heard back from FAC.[144] Seamont called on several occasions, but was unable to obtain information on the current state of the *Jurel*. Finally the lease lapsed in June.[145]

VII. Catch

Bermuda's pelagic fishery has in recent years, since the 1990 pot ban, assumed an increasingly important part in the country's fishing industry. Landings have increased from about 140 t in 1990 to over 200 t in 1998. Most of that increase has come as a result of expanded landings of the two principal species, tuna and wahoo, which generally constitute over 75 percent of Bermuda's catch. The longline catch to date has accounted for only a small fraction of the island's pelagic landings and a substantial portion of that catch has been taken by foreign vessels operating under charter. Swordfish catches have been minimal. Small quantities have been reported, but they have primarily resulted from the chartered foreign vessels. Bermuda reported a record 8.9 t of swordfish landings in 1998.

A. Chronology

Bermuda officials note that substantial fluctuations in pelagic catches can occur due to natural cycles. Some of the reported fluctuations, however, represent important developments in the fishery. Some of the major trends in the Bermudian pelagic fishery are as follows:

1974: An annual billfish tournament was organized in 1974 and has been held every year since.

1975: An annual fisheries database was set up, based on a compulsory self-reporting scheme. Fishermen reported a marlin catch of 1 t (appendix B4b).

1979: Fishermen began to improve their fishing gear and methods. Some better vessels were added to the fishery. As proficiency in the fishery increased, directed fishing expanded.[146] The marlin catch reached 5 t in 1978, but fluctuated substantially from year to year (appendix B4b).

1984: A fisherman landed a 513 kg blue marlin, generating considerable interest in Bermuda among recreational fishermen. It was, at the time, the third largest blue marlin ever taken in the Atlantic Ocean.[147]

1985: Marlin catches reached 9 t (appendix B4b). A strong conservationist movement began to develop in the mid-1980s which promoted tag and release fishing in the marlin fishery.[148]

1987: Catches of tuna and pelagic species declined in 1987. DAF official believe the decline was part of a cyclical trend. Unusual oceanographic conditions associated with Gulf Stream eddy currents may have also affected the distribution of highly migratory pelagic species. In addition to the domestic fleet, the DAF licensed 33 Taiwan longliners targeting albacore

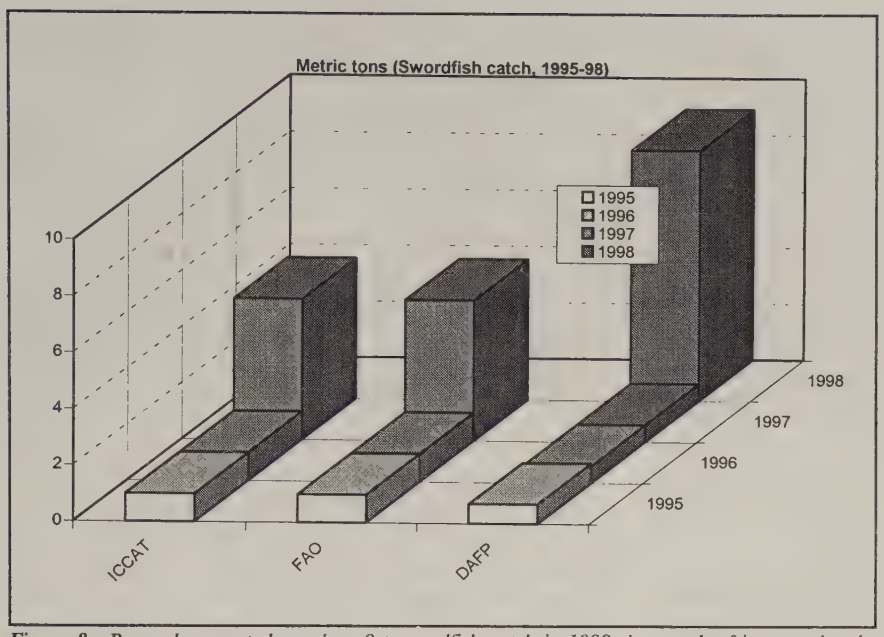

Figure 8.--Bermuda reported nearly a 9 t swordfish catch in 1998, but much of it was taken by foreign longliners under charter.

in the outer 150 miles of Bermuda's 200-mile EEZ (appendix D2a). The Taiwan fishermen operated from October to March.[149] Foreign operations could have also affected domestic landings.

1988: The DAF conducted test fishing with monofilament longlines aboard the *R/V Calamus*, primarily targeting yellowfin tuna. Only modest success was reported.[150]

1989: The DAF continued experimental longline operations in 1989.

1990s: Bermuda fishermen reported no swordfish in the early 1990s (appendix B3a). Billfish catches were noted during this period (appendices B4a-b). Yellowfin tuna catches were also reported.

1992: Fishermen reported a substantial increase in the yellowfin tuna catch during 1992.

1994: The United States reported swordfish imports during 1993-94, mostly 1994 (appendix F2a1), but this was due to transshipments by Canadian fishermen and not domestic catches. Bermudian fishermen reported poor catches of wahoo--one of the major pelagic species taken in Bermuda (appendices B2a-b).

1995: The pelagic fishery reported a substantial increase, reaching record levels of over 180 t in 1995 (appendix B2b). Bermudian fishermen reported their first swordfish catch of 0.7 t in 1995 (appendix B3a). This may have resulted from the Canadian longliner *Alexis I* brought to Bermuda by businessman Neil Inchcup.[151] Fishermen reported a recovery of the important wahoo fishery and record landings in 1995 (appendix B2b).

1996: Pelagic fishermen set an all time record of over 200 t in 1996. Bermudian fishermen reported another small swordfish catch of 0.6 t in 1996 (appendix B2b). Again the swordfish catch may have been mostly taken by the Canadian longliner *Alexis I*. Bermudian fishermen also began to longline in 1996. Notably ICCAT reported the incorporation of two longliners in the fleet (appendix A2a). The yellowfin catch increased in 1996, reaching an all time record of 67 t, presumably because of the increased longlining (appendix B2b).

1997: Bermuda initially reported a swordfish catch of 5.0 t in 1997, but the latest statistics note only 0.6 t (appendix B3a). This was partially the result of increasing domestic longline activity. The DAF also reported that one company leased a longliner.[152] The yellowfin catch declined in 1997, but was still well above levels earlier in the decade (appendix B2b). The DAF reported a sharp decline in blue marlin catches.

1998: Bermuda reported a swordfish catch of 8.9 t (appendix B3a). Seamont Fisheries worked with two foreign charter boats. The *Alexis I* was still active at the beginning of the year. Seamont also chartered the Cuban longliner *Jurel* in 1998 complete with its Cuban crew and it was licensed by the Government for operations in Bermuda's 200-mile EFZ.[153] The first catches from the *Jurel* were landed in December 1998.[154] Domestic longliners were also active. The charter vessels appear to have landed 5.0 t of swordfish and the domestic longliners 3.9 t (appendix B3a).

1999: Domestic catch data is not yet available for 1999. The chartered Cuban longliner *Jurel* landed fish in Bermuda a few times during early 1999.[155] Excessive sharks caused the Bermuda leasing the vessel to refuse to accept the catch in June 1999.[156] Two domestic longliners were reported tied up and idle (appendix A2b).

2000: Attempts by Seamont Fisheries to extend the lease of the Cuban longliner *Jurel* proved unsuccessful and the lease expired in June 2000. Seamont tried unsuccessfully to purchase a used U.S. longliner.[157] Officials report, however, that the domestic longliner *Trilogy* reported several successful trips.[158]

B. Species

1. Swordfish

Bermudian fishermen catch minimal quantities of swordfish. Small landings have been reported, however, since 1985--mostly by foreign fishermen doing test fishing or working under contact to a Bermuda company. Bermudian fishermen have begun deploying a few small longliners with mixed results, but the 1998 landings data indicates that the domestic fishermen are landing some swordfish (appendix B3a). As of mid-2000, one of the three Bermuda longliners know to the authors were tied up idle (appendix A2b). Only one of the two remaining longliners in 2000 reported successful fishing operations.[159]

Bermuda first reported swordfish catches in 1995. The catches during 1995-97 have been less than 1 t and some of that was reported by foreign charter vessels. Bermuda had reported a 5 t catch in 1997, but the most recent catch data reported by Bermuda shows only a 0.6 t swordfish catch (appendix B3a). A much more substantial catch of 8.9 t was reported in 1998. Bermuda for statistical purposes includes the catch of the charter vessels as part of its national fisheries catch.[160] Most of the Bermuda's 1998 swordfish catch was in fact reported by the foreign charter vessels, but Bermudian domestic fishermen reportedly landed about 3.9 t (appendix B3b). While the domestic catch is still quite small, the fact that at least one of the longline operations is achieving some success, suggests, that Bermudians are beginning to acquire the necessary skills and technology upon which a longline fishery can be based.

***Photo 19.--** Artisanal fishermen land their catch on a large number of beaches and other landing sites scattered along the coast. Dan Hellin.*

2. Other Species

While domestic swordfish catches have been very limited, Bermudian fishermen have since 1990, when the pot fishery was closed, been expanding the pelagic fishery. Most of the increase has come with increased wahoo and tuna catches, but several other species are involved as well. Foreign fishermen also catch a variety of other pelagic species in the Bermuda EEZ. These include tuna (albacore, bigeye, yellowfin, and bluefin) and sharks.[161] Much of the Taiwan catch, for example, was albacore.[162]

Wahoo: Wahoo is the mainstay of the domestic pelagic fishery. Wahoo catches have been increased from less than 75 t in 1990 to a record 108 t in 1998. Over half of the pelagic catch is wahoo. The DAF notes that some of the increase in wahoo catches may be natural cycles, but the increase is in part also related to increasing directed effort.[163]

Tuna: Tuna, which used to be taken in only small quantities, has become a major part of the Bermudian catch. Fishermen have increased tuna catches at an even more rapid pace than wahoo. The 1996 record yellowfin catch of 67 t was a 50 percent increase over the 15 t 1990 catch. Blackfin tuna catches have declined, but albacore catches are increasing (appendix B2b). The yellowfin catches since 1996 have declined somewhat. Foreign fishermen have taken large quantities of tuna, especially albacore, around the island. In doing so they have reported a swordfish bycatch (appendices B7 and D1c).

Sharks: Bermuda officials do not include sharks as a part of the pelagic catch. Bermuda officials report that shark landings have not increased since the 1990 ban, suggesting that fishermen have shown little interest in targeting the various species. Landings have in fact decreased from 12 t in 1990 to 9 t in 1998 (appendix B5).

Billfish: Bermuda reports a billfish catch, mostly blue marlin. As a result of conservation efforts, however, the marlin fishery has become primarily a tag and release fishery. Officials believe that because of the catch and release effort that available statistical data

Photo 20.-- Bermuda is a popular port of call for cruise ships which dwarf the local recreational and artisanal fishing vessels. Dan Hellin.

may be somewhat unreliable (appendices B2b and B4a). The data shows a sharp decline in billfish landings in 1997 and 1998. Blue marlin landings, for example declined from 13.4 t in 1996 to only 4.6 t in 1998.[164] Given the extent of the foreign longline effort off Bermuda, substantial quantities of billfish have been taken, dwarfing the domestic catch. Some reports indicate that the billfish bycatch of the Taiwan fishermen was very substantial (appendix B7).

VIII. Ports

Bermuda has no centralized fishing port. There are a large number of scattered mooring sites in the many small bays and coves along the coast.[165] Bermuda's major port is St. Georges, located at the northern tip of the main island. The fishermen, however, land their catch at about a dozen points around the island. Many of the fishermen operate from Hamilton.[166] While there are some locations that are popular landing sites with the fishermen, much fish is landed at scattered mooring sites. Most fishermen land their fish at their vessel mooring.[167]

IX. Transshipments

The Government of Bermuda, with minor exceptions, does not keep transshipment data of seafood or other commodities occurring through Bermudian ports. Therefore it is not possible to either identify or quantify exports of fish by foreign vessel from Bermuda. Foreign fishing vessels, including U.S. vessels, have occasionally transshipped tuna, swordfish, and other species through Bermuda to various locations in the United States and Canada. A Bermudian official confirmed that transshipments of fish have been and continue to be made through Bermuda.[168] A license is not required for these fish transshipments. It is a condition of the Bermuda foreign fishing vessel license, however, that no fish be landed for actual sale in Bermuda. The fish landed by the licensed foreign vessels can only be transhipped to foreign markets.[169]

Bermuda during the 1960s and 1970s was a convenient transshipment and supply point for distant-water fishermen vessels fishing off the coast of Canada and the United States. Many of the vessels were based in Las Palmas in the Canary Islands and the ability to transship in Bermuda permitted them to spend more time on the fishing grounds. Little information is available on these transshipments. Bermudian sources have occasionally reported substantial transshipments through Bermuda. A report received in 1977 indicated that during February 1977 about 15 foreign trawlers (Korean, Japanese, and Italian) were landing various species of fish at St. Georges.[170] Presumably this fish was being transshipped. Transshipments through Bermuda during the 1990s are believed to have been limited, although the Canadians did tranship some swordfish in 1993-94.

Canada: Canadian fishermen which purchased Bermuda licenses in 1994, landed fresh bluefin and swordfish in Bermuda and airshipped it to foreign markets. The 12 t of swordfish imported by the United States in 1994 was probably product transhipped by the Canadians (appendix F2a1).

Japan Some historical data available on the Japanese provide details on the transhipment operations (appendix C). The fish involved appears to be largely squid and butterfish taken in fisheries off the U.S. and Canadian coasts. The activity declined sharply in the 1980s as both the United States and Canada restricted foreign fishing. Subsequently Japanese longliners have shifted to at sea transfers rather than transhipping through foreign ports.

Photo 21.--This yellowfin has been landed by the "Alexis I". It will be processed to order for mostly restaurants and hotels catering to the tourist industry. Seamont Fisheries

Italy: No data is available on Italian transshipments, but Bermudian sources report that the Italians during the 1970s and early 1980s were, like the Japanese, transshipping squid and butterfish taken in fisheries off the U.S. and Canadian coasts to Europe. The Italian transshipments apparently included some swordfish The transshipments, like the Japanese transshipments declined sharply in the 1980s as both the United States and Canada restricted foreign fishing.[171]

Spain: Spanish longliners have transhipped swordfish to the United States through Bermuda.[172]

Taiwan: The Taiwan fishermen who were the primary foreign fishermen purchasing Bermuda licenses rarely called in Bermudian ports or transhipped product. They operated out of the Japanese transshipment facility on St. Maartens.

X. Processing and products

Little commercial fish processing occurs in Bermuda. Most of Bermuda's catch is sold whole to hotels and restaurants.[173] The companies/vessel owners handling tuna and swordfish have primarily sold it in the local market and will process it to order. Seamont Fisheries, Craig Trott, and Robert Lambe since 1996 have been supplying varying quantities, Details on the product forms are not available. One fisherman reported small exports to the United States, but the authors have not noted any shipments reported in U.S. trade data since 1994 (appendix F2a1). Exports to the United States are unprocessed trunks, but the local sales are processed to order. The fishermen/company report preparing steaks, chunks, and fillets for their domestic clientele.[174] One fishermen reports that processing and maintaining high-quality product is difficult on Bermuda. He notes that there is a shortage of available flake ice and the marketing system is not well developed.[175] Some of the fishermen are discussing the possible construction of a processing plant near the airport to facilitate possible future exports.[176]

XI. Organizations

A. Trade associations

The principal trade organization connected with fisheries on Bermuda is the Commercial Fishermen's Association (CFA) which was formed in the early 1970s. The formation of the CFA initiated a commitment by full-time fishermen genuinely interested in protecting and enhancing Bermuda's fishery resources.

B. Companies

No Bermuda company handles any significant quantity of swordfish and there is very limited seafood processing of any kind. There are no large companies operating fleets of fishing vessels. Most fishing vessels are owned by individuals who often sell their catch at the pier or to restaurants who have placed standing orders for specific species.

(Michael) Barns: The Bermuda fishery is conducted by a number of small-scale fishermen. One such operation is conducted by Michael Barns. Mr. Barns has since the authors spoke to him been charged will illegal pot fishing and the case is currently in court. Barns operates two boats. The first, *Vitamin Sea*, a 10-m fiberglass boat with a 350 diesel engine. He operates another boat, *Lone Star*, with a partner. It is 13-m fiberglass boat with a 240 hp motor. They use to deploy traps, but since the 1990 ban, they have been trolling and drop lines for demersal species. The 1990 ban was a big shock to Barns and other fishermen, many of whom were forced out of the fishery. Others had trouble adjusting to new fishing methods. They fish on the Argos Bank. It is further out than fishermen with smaller boats can reach. Also the rougher waters discourage some fishermen so it is not as heavily fished as closer in grounds. The main target species are yellowfin tuna and wahoo which are taken by trolling. He deploys five lines with 2 hooks, each baited with frozen ballyhoo. When targeting demersal species (snappers, groupers, parrotfish, and others) he sets 6 lines of 15 hooks each baited with frozen squid. The yellowfin he takes average about 60-65 kg and wahoo range from 45-55 kilograms. He reports daily catches of about 90 kg of fish per boat. He normally goes on 1 day fishing trips, about 6 days per week. The fishery is very seasonal. Pelagic catches are best in February, April, and September. Demersal species are taken all year round, but are best in May and October. Fishing is often suspended in December and January for the holidays. The best customers are the Lobster Pot and an Italian restaurant chain. Yellowfin sells at $3.60/kg and wahoo at $2.00/kilogram.[177]

Bermuda Export and Import: This wholesaler imports seafood.

(Robert) Lambe: Robert Lambe is one of the most experienced Bermuda fishermen. He initiated the Bermuda longline fishery when he began operating the *Princess K* in 1993. He currently operates the *Ark Angel* out of the west coast of Bermuda. This is his second longliner. He targets swordfish during the fall. Lambe is the only longliner that has managed to arrange for duty relief on taxes for fuel. Local officials indicate that Lambe is to date the most successful Bermuda longline fisherman and has been

Photo 22.--This tuna is being landed by one of the foreign leased longliners. The Bermuda company leasing the longliner is in the process of acquiring its own longliner. Seamont Fisheries

actively fishing in 2000.[178]

Seamont Fisheries: Seamont Fisheries was founded by Bermuda businessman Neil Inchcup in 1995. The company worked with the Canadian longliner *Alexis I*, a 32 m longliner, in 1996. Seamont arranged for a Bermuda fishing license and handled the catch landed in Bermuda. The captain and crew were Canadian, except for one Bermudian who worked as the engineer. The company tried to recruit other Bermudians, but found few interested candidates. Most of the catch was sold locally to tourist hotels and restaurants. Seamont reports that local customers were pleased with the quality of the catch provided, as well as the species such as swordfish and tuna which the local artisanal fishermen were not supplying in quantity. As a result of the company's tuna and swordfish catch, Bermudian Fishery Officials began to consider participation in ICCAT meetings. Seamont worked with the *Alexis I* from 1995 to 1998. The vessel was an older vessel and maintenance costs escalated in 1998. As a result, Seamont decided to terminate the contract.[179] Earlier Canadian vessels trying to work out of Bermuda had difficulty with the Canadian Government because of the country's limited ICCAT allocation.[180] As a result, Seamont arranged to transfer the *Alexis I*'s registration to Bermudian flag. The company considered various alternatives and in 1998 decided to charter a Cuban longliner from the Flota Atunera de Cuba (FAC).[181] The Cuban longliner *Jurel* began operating in Bermuda waters in late 1998 and landed the first catch on December 4, 1998. The catch consisted of swordfish (3.6 t), mako shark (1.4 t), spearfish (0.3 t), white marlin (0.1 t), and bluefin tuna (0.1 t). It was all sold locally. Only a few tunas were taken, but they averaged 45 kilograms.[182] The 38-m vessel had a 26-man Cuban crew.[183] Again, one Bermudian was added to the crew.[184] The *Jurel* landed its catch at Ship's Wharf, St. David's.[185] One source indicated that the Bermudian Government strongly supported the company's efforts to launch a longline fishery. Company officials reported working directly with Environment Minister Arthur Hodgeson.[186] The Cubans apparently offered to provide training for local fishermen as well as Cuban goods like cigars. The presence of the Cuban longliner proved highly controversial. The size of the Cuban vessel appears to have disturbed many Bermudian fishermen who operate small boats. The company also reported that they had difficulty with the captain of the vessel. After the first trip in December 1998, the captain began delivering large quantities of shark.[187] Except for makos, however, there is little demand for shark in Bermuda. Seamont asked the captain repeatedly to target other species, but he continued to deliver mostly shark. This substantially reduced the income the company could generate and meant that the costs of maintaining the Cuban longliner exceeded revenue. As a result, Seamont had to refuse to accept fish from the *Jurel* in June 1999.[188] In addition, operating the vessel proved much more expensive than Seamont had anticipated. Seamont continued trying to work with the Cubans, but FAC failed to responded to repeated inquiries in 2000.[189] Seamont reported that their leased expired in June 2000. Owner Neil Inchcup decided that it would be less expensive to purchase a smaller longliner than to continue chartering foreign vessels. He tried to buy a U.S. longliner in California during June 2000, but the negotiations failed.[190] The company reports that the Ministry of the Environment is encouraging them to launch longline operations. The Ministry reportedly wants to increase utilization of offshore resources to reduce pressure on the heavily fished inshore resource. The Ministry reportedly wants to use Seamont as a prototype for other Bermuda companies.[191] DF officials declined to comment on the Government policy toward longlining.[192]

(Craig) Trott: Craig Trott purchased the fiberglass longliner *Cutlass* in 1994, but has since replaced it with the larger *Trilogy*. Trott is a former DAF employee who worked with fisheries development. He operates off Bermuda's eastern coast and targets swordfish and albacore, but takes yellowfin and wahoo as a bycatch. Almost all of the catch is sold domestically, but small quantities have been exported. Trott reports that a FAO course on fisheries quality control proved very helpful.[193] No data is available on catches and actual fishing operations have reportedly been limited to date. One observer reports that the *Trilogy* in 2000 has rarely been deployed on actual fishing trips.

Valleys and Butterfield: This wholesaler imports seafood.

Viking Seafood: This wholesaler imports seafood.

C. Unions

The Fisheries Division of the Bermuda Industrial Union (BIU) represents both boat owners and crews on fishing boats. Because Bermuda fishing boats are small, crews are often only two or three individuals. The BIU has actively participated in the debate over vessel charters. The BIU recognizes that there is some support for chartering foreign vessels, even with foreign crews, as an initial stage in the development of the longline fishery. Such ventures could represent training opportunities. Differences exist on how rapidly such ventures could be Bermudanised.[194] The authors note, however, that on the charters so far conducted, BIU members had little interest in working aboard the foreign vessels as crew members.

XII. Markets

A. Domestic

Seafood is popular in Bermuda with both local residents and tourists. The local fishermen reportedly have little difficulty selling their catch, even though prices are relatively high. Fish is in such high demand that often the fishermen will have buyers lined up even before leaving on the fishing trip.[195] Prices of local fish tend to be higher than imported product (appendix E).

Much of the catch is sold fresh, often at the dock in open air fish stands.[196] There is no central fish market on Bermuda.[197] Individuals often come to the landing sites to buy the catch.[198] Fish is also sold along the road side. These are often cash transactions.[199] Restaurants and hotels use about 12.7 t of fish monthly while supermarkets handle about 6.4 tons.[200] The fishermen often sell directly to hotels and restaurants. Chefs and retailers are, however, highly selective and almost never buy locally filleted fish. They are reportedly interested in only about 30 percent of the local catch--primarily wahoo, traditional demersal species, and small quantities of tuna.[201]

Wahoo is the pelagic species most preferred by Bermuda consumers. Tuna and swordfish have not been widely consumed in Bermuda where the population is more familiar with snappers, groupers, and other demersal species taken inshore. There is some demand, however, from the country's important tourist industry.[202] Many of the tourists visiting Bermuda are Americans and they often ask for swordfish and increasingly tuna. In addition, with the declining availability of demersal fish and the expansion of the pelagic fishery, tuna has become more available on Bermuda and the public has become increasingly familiar with it. The public is still generally unfamiliar with swordfish, but it does sometimes appear on the menu as American tourists especially like swordfish and often ask for it.

B. Trade

1. Exports

Some swordfish is shipped from Bermuda. It does not appear to have been exports, however, but rather transshipped product landed by foreign fishermen. All such shipments are shipped to the nearby United States or Canada. Bermuda officials believe that U.S. import statistics might be in error. The shipments were handled by a Canadian broker and the DAF had assumed the product was shipped to Canada. They now believe that shipments to the United States may have been involved.[203]

1986: Bermuda shipped 11 t of fresh swordfish to the United States in 1986. The origin of those shipments is unknown.

1987-92: Bermuda shipped no swordfish.

1993: Small quantities of fresh swordfish were shipped in 1993, probably product landed by licensed Canadian fishermen. U.S. import data indicates 0.5 t was shipped to the United States (appendix E2a1). Bermuda officials know of no shipments to the United States, but report that less than 1 t was shipped to Canada.[204]

1994: U.S. import data indicate that Bermuda shipped over 12 t of fresh swordfish in 1994 (appendix E2a1). The authors had assumed that all or most of this product was swordfish transshipped by Canadian longliners. Bermuda officials, however, assure the authors that there were no such shipments in 1994. They indicate that while there are no restrictions on transshipments, the FD "keeps close tabs on the movement of fish."[205]

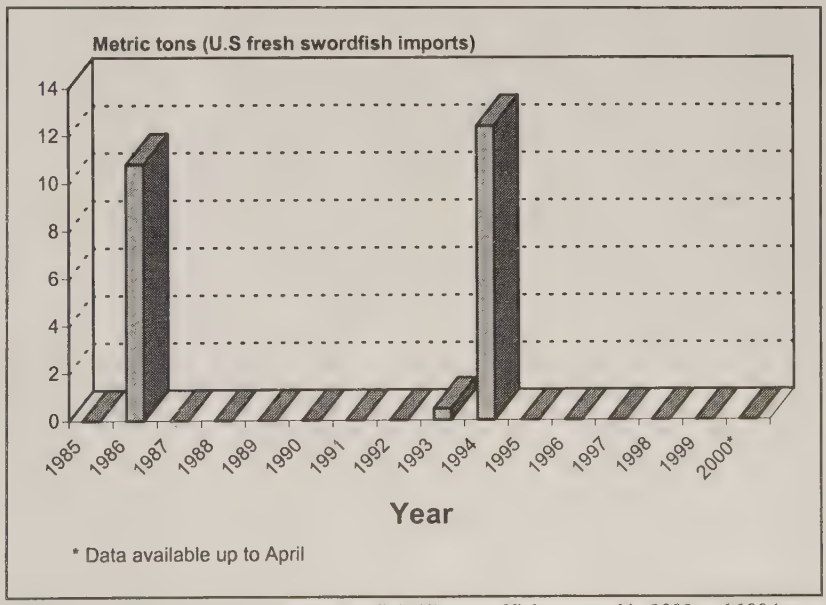

Figure 9.-- Bermuda rarely exports swordfish. The swordfish exported in 1993 and 1994 were landed by Canadian fishermen.

1995-99: There have been no known swordfish export shipments since 1994 (appendix F1).

Two of the Bermuda longline operations (Seamont and Trott) report exporting tuna or swordfish to the United States. The quantities involved, however, have been quite small as the primary focus has been to supply the domestic market.

2. Imports

Bermuda fishermen in the late 1990s complained about increasing competition with imported product. Several companies (Bermuda Export and Import, Valleys and Butterfield, Viking Foods, and several smaller operations) are importing frozen fish which they can often supply on a more regular basis than the local fishermen and in greater variety.[206] Imported product is also cheaper as well having a number of advantages such as reliable availability. One factor of importance to Bermuda is the tastes of the American consumer. Americans make up the bulk of the tourists visiting Bermuda. Americans like seafood, but have a strong preference for shellfish. Local fishermen can not supply some favored species like shrimp or only inadequate quantities of other species such as lobster. As a result substantial quantities of shellfish must be imported. Some local consumers report that a few fishermen supplement their own catch by importing fish. Customers are sometimes confused about what is locally caught and what is imported.[207]

Bermuda imports small quantities of swordfish. American tourists often ask for swordfish at seafood restaurants, assuming that because Bermuda is an island that there will be a plentiful supply of swordfish. A similar pattern occurs on many Caribbean islands where tourists often ask for favorite species which may or may not be taken by the local fishermen. Some restaurants and hotels thus import small amounts of swordfish.[208] This is difficult to quantify, however, because the United states does not have a swordfish export code.

XIII. Government Policy

The Bermudian agency responsible for fisheries is the Fisheries Division (FD) in the Department of Agriculture and Fisheries (DAF). Formerly the ministry was known as the Department of Agriculture, Fisheries, and Parks. The DAF's efforts have been almost entirely directed at inshore demersal species. The DAF is assisted by a Fisheries Advisory Committee comprised of individuals drawn from the fishermen and business community.

A. Limits

The British declared a 200-mile Exclusive Fishing Zone (EFZ) in 1977.[209] Bermuda maintained its EFZ from 1977 until 1996. The reason that Bermuda had a EFZ and not an Exclusive Economic Zone (EEZ) during this period is that in 1977 the United Kingdom did not recognize the existence of EEZs. After the Law of the Seas Convention came into force, British policy changed. As a result the British in 1996 established a 200-mile EEZ around Bermuda.[210] The British had earlier established a 12-mile Territorial sea for Bermuda in 1988.[211] Bermuda's physical isolation made it one of the few countries declaring a 200-mile zone and not having to negotiate marine boundary agreements with neighboring countries. The United Kingdom signed part XI of the Law of the Seas Convention in 1994, but has not yet ratified it.

B. Fisheries law

The principal fisheries law is the *Bermuda Fisheries Act of 1972* which authorizes the DAF to manage the fishing industry. The Fisheries Act and resulting regulations primarily address local inshore fisheries. Some of the provisions, however, are general and also apply to offshore waters as well.[212] The DAF registers and licenses fishing boats and fishermen, collects statistics, and issues regulations governing specific fisheries, gears, and fishing areas.[213] The catch of some of the most popular species have declined very sharply in recent years and the DAF has had to severely limit fishing effort on those species. A three-member Commission of Inquiry has examine the future of the industry and the long-term protection of the marine environment.[214] One of the principal restrictions were on fish traps.[215] These regulations have proven highly controversial on Bermuda.[216]

The Government attempted to deal with over fishing by limiting pots and then by limiting licenses

for pot fishing to full-time fishermen. Eventually under the 1984 Management Plan, a moratorium was declared on new entrants. Government officials determined that even with these restrictions that the resource was still being extensively overfished. As a result, with the 1999 Management Programme, the Government closed the pot fishery. Fishermen were offered *ex-gratia* payments depending on the catch and effort previously reported. The closure was, as Bermuda officials described it, "elegant in its simplicity," but it raised concerns over the spillover into other fisheries.[217] Surprisingly, however, only a few Bermuda fishermen have since entered the longline fishery.

C. Fishing licenses

1. Foreign fishermen

The Bermuda Fisheries Act provides for the licensing of foreign fishing vessels. The DAF began licensing foreign vessels in 1978 after the 200-mile EFZ was established in the previous year. The DAF accepts applications and issues licenses on an annual basis (appendices D2b and D3c). DAF officials decided to base the registration fee on vessel size rather than catch tonnage to simplify the surveillance problem and to help obtain accurate catch data.[218] The fee was set at $1,000 annually plus $1 per GRT.[219] Later the fee was increased to $3,000 annually plus $3.00 per GRT. Effective on April 1, 1996, these fees were to be increased to $3,150 annually plus $3.25 per GRT.[220] The licensing fee in 2000 was set at $3,500 plus $3.50 per GRT.[221] Licensed fishermen are required to have a local agent and must contact the Bermuda Harbour radio on entering or departing Bermudian territorial waters.[222] The DAF in an effort to simplify the licensing process requires no umbrella agreements with foreign governments, but issues such licenses directly to interested foreign vessel owners.

Foreign fishermen have acquired Bermuda fishing licenses primarily to have access to fishing grounds within the Bermuda 200-mile EEZ. Fishermen report particularly good catches in the EEZ. A Bermudian official reports that the good catches can be attributed to the prevailing ocean conditions within Bermuda's EEZ such as areas of upwelling, and the passage of Gulf Stream eddy currents, among others. Also, the foreign fishermen are attracted to fish in Bermudian waters due to the extent of the EEZ, fully 200-miles around the island as no other jurisdiction is close enough to require the negotiation of a marine boundary agreement. This gives Bermuda a EEZ of about 320,000 square kilometers. In addition, the island's proximity to U.S. market makes it a convenient location to land fish for export to the United States. Foreign fishing vessels, with few exceptions, are prohibited by U.S. law from landing fish directly at U.S. ports.

A license is not required for the transhipment of fish through Bermuda and it is a condition of the Bermuda foreign fishing vessel license that no fish be landed for sale in the country.[223] Special permission has been given, on occasion, for foreign fishermen to land fish for sale in Bermuda, but these were vessels chartered by Bermuda companies, not vessels operating with foreign fishing licenses and thus treated differently under Bermuda law (See "D. Foreign Charters" below.) The foreign fishermen operating with licenses have primarily targeted albacore, swordfish, and other tuna species.[224]

Bermuda has in some years issued substantial numbers of licenses. The Government of Bermuda, however, only issues fishing licenses to foreign fishermen if these are engaged in longline fishing operations.[225] One 1981 report indicated that Bermudian authorities had licensed about 40 foreign longliners (presumably in 1979 and 1980), earning $40,000 in licensing fees.[226] Most of the licenses have been issued to the Taiwan longline fleet targeting albacore. The vessels were required to fish beyond the innermost 50-miles of the 200-mile EFZ as well as provide catch data and training and employment opportunities for Bermudians.

The number of licenses issued by Bermuda had fallen to 10-13 by the early 1900s. The numbered issued fell even further to only 3 in 1995. Since 1995, no licenses have been issued to foreign longliners (appendix D3c). This is the result of falling interest among the foreign fishermen and not any change in Bermuda's policy. The decision of the Taiwan fishermen to stop purchasing Bermuda licenses was primarily due to two factors. One, Bermuda implemented additional terms and conditions followed the grounding of a Taiwan longliner on a Bermuda coral reef. Two, the Taiwan fleet shifted to targeting bigeye on grounds south of Bermuda at more tropical latitudes..[227] Most of the licenses issued during the 1980s and early 90's were purchased by Taiwan longliners working under contract for a Japanese company on St. Maarten. The Japanese company, however, sharply reduced the number of applications in the early 1990s, although as late as 1994, 10 licenses were issued to Taiwan fishermen. Since 1995, the Japanese Nichirei subsidiary on St. Maarten has not purchased any licenses for the Taiwan fishermen they charter.[228] This is primarily because the Taiwan

longliners have shifted their focus from albacore off Bermuda to bigeye at more tropical latitudes.[229]

Bermudian officials report that Bermudians have been reluctant to work aboard the Asian (Korea and Taiwan) longliners because of the general lifestyle of the Asian crews and the extended length of the fishing trips. As most of the licenses have been issued to Asian countries, this has significantly reduced the training benefit originally foreseen.[230]

Bermuda during the 1990s has issued much smaller numbers of fishing licenses to foreign fishermen than in the 1970s and 80s. Besides the Taiwan fishermen, only a few licenses have been issued to Canadian fishermen. Details on other countries purchasing licenses have not been issued by Bermudian officials. License fees currently range from $3,000-5,000 per vessel. The Bermudian Government asks that applications be submitted by September. The licenses require all the fish caught to be landed and no fish be discarded at sea.[231]

The DAF reports that while the Taiwan longline fleet has reduced its effort off Bermuda and stopped purchasing licenses that a few Bermudian fishermen has begun applying for longline licenses. While regulations for foreign fishing have not changed, the DAF would now evaluate applications for licenses much more carefully to ensure that the foreign fishermen would not adversely affect the operations of the domestic fleet. No licenses were issued to foreign fishermen in 1999 and as of mid-January 2000 not applications have been received for 2000.[232] The authors attempted to contact FD officials for authoritative information on the foreign licensing program, but they declined to provide details on the arrangement until clearance is obtained from the DAF.[233] The only foreign longliner know to operate in the Bermudian EFZ during 1999 was the Cuban longliner *Jurel* which operated under a leasing arrangement with a Bermuda company and not a foreign fishing license.[234] As of early 2000, no foreign longliners were operating in the Bermudian EFZ and no applications for such licenses had been received.[235]

2. Domestic

a. Commercial

A Bermuda fishing license is not a permission to fish. Bermuda officials explain that actual fishing does not require a license. A license is, however, required to sell fish once caught. Fish to be sold must be caught aboard a licensed fishing vessel and sold by a registered fisherman.[236] Fishing vessel licenses have been nominal, but since 1996 the DAF has been increasing the fees, in part to reduce the number of "ghost licenses". The fee for the 1998/99 season was $150, but this was doubled to $300 for the 1999/2000 season. Boat owners are also required to have their vessel inspected by the Coast Guard which costs about $100 annually.[237] There is also a nominal fee of $15 to register as a fisherman. This is important as only registered fishermen can sell fish in Bermuda.[238] It means, however, that many fishermen have registered their entire families so they can help sell fish.[239]

License holders have to report their catch weekly. To reserve the fishery for serious fishermen, operators have to fish at least 100 days or 800 hours annually or their license can be canceled. Fishermen say, however, that this is not seriously enforced. One fishermen said that of the 200 or so fishermen with boats only 70-80 fishermen operate full time.[240] Official statistics report that 189 fishing vessels were licensed in 1998, and that there were 62 full-time operators--only about one-third of the total (appendix A1). Most fishermen want to retain their commercial license even though they are not actively fishing because if they just have a recreational license, they can not sell their catch.[241] There are also a variety of benefits including the purchase of fuel and boats without paying an import fee.[242] This situation may affect the accuracy of the Bermudian fishery statistics. The Marine Resources Board is responsible for determining full-time status. Fishery officials are not satisfied with the current subjective standards and the practice of accepting unverified reports from the fishermen. Various alternatives are under consideration.[243]

Commercial fishermen must complete a statistical report for each fishing trip. This is the FD's primary source of information on catches and fishing effort. The validity of this data has been questioned, however, because of the financial consequences or potential advantages in maintaining one's commercial license. Fishermen are exempted 50 percent of the duty on fuel and boats. Fishing gear can be imported duty free. Thus some fishermen may be padding their reports to ensure that they qualify for a commercial license. This is the opposite of several other countries where fishermen may under report their catch. Bermuda has, however, no income tax, so under reporting is apparently not a problem.

b. Recreational license

Bermuda currently does not require a recreational fishing license. Neither residents or tourists visiting the island need to obtain a recreational fishing

license.[244] If a recreational fisherman, however, wants to sell his catch, he must register his boat and obtain a commercial fishing license. Many Bermuda recreational fishermen operating charter boats are former commercial fishermen who see the sale of the catch as an important part of their income. Recreational boats require Coast Guard inspection. If a recreational fishermen wants to operate commercially he needs to have a second $100 inspection.[245] Many of the older operators have obtained commercial licenses so they can sell their catch, but at the present time this is difficult because of Bermuda's limited entry system for commercial fishermen. Bermudian officials are considering instituting a recreational fishing license and are studying the various options for such a licensing regime.[246]

D. Foreign charters

A few foreign longliners have been chartered by Bermudian companies. Such vessels do not have to obtain foreign fishing licenses and during the period of the charter are considered under Bermuda law as domestic fishing vessels and can thus land their catch for sale in Bermuda. Their catch is included statistically as part of the Bermuda fisheries catch.[247] Longliners from several countries have been involved in these charter attainments. Much of the Bermuda swordfish catch has been landed by these charter vessels. The charters known to the authors include:

Canada: Seamont Fisheries chartered the Canadian longliner *Alexis I* during 1995-98.

Cuba: Seamont Fisheries chartered the Cuban longliner *Jurel* during 1998-99.

United States: A U.K.-based firm in 1993 arranged for a special permit to be granted the U.S. longliner Anna C. The authors are unsure about the precise status of the vessel, whether it was a charter or operated under a special test fishing permit.

E. Fisheries policy

The Bermuda Government would like for its fishermen to diversify operations and target lightly exploited offshore resources. The Government obtained FAO/UNDP funding in the late 1970s to help develop lightly exploited resources (such as marlin, tuna, and shark), initially for inshore, but eventually for offshore operations as well. [248] The authors have few details on the results of the project. The DAF is known to have financed experimental longline fishing with monofilament line. The results of this test fishing appears to have been modest during the 1980s.[249] Bermudian fishermen conducting mostly small-scale inshore operations have shown little interest in initiating offshore operations. Investors have likewise been unwilling to make major investments to launch an offshore commercial fishery. Subsequent reports from Bermuda, however, reveal that a few fishermen have attempted to longline offshore with tuna and swordfish the primary target species.[250] This is confirmed by the still small, but increasing swordfish catch. Bermuda reported a domestic catch of 5 t in 1997. (See "Catch".)

Bermudian officials are increasingly concerned about inshore stocks. Environmental Minister Arthur Hodgson, who is responsible for marine resources and the fishing industry, tabled a green paper in early 2000 on the condition of Bermuda's marine environment, which has suffered from serious over-fishing of some reef fish. The discussion paper looked at: 1) licensing reform for fishermen and boats, 2) a monitoring system for vessels fishing offshore, 3) streamlining the process for prosecuting violators, 4) penalties for those purchasing fish from unlicensed fishermen, 5) a total allowable catch (quota) for the most heavily fished species to slow over-fishing, 6) the creation of a marine parks system, and several other proposals. The report expresses strong support for the continuation of the fish pot ban (enacted in 1990) to protect over-fished species, increased conservation, and reduction of pollutants.[251] While most of these steps concern the inshore fishery for demersal species, they show case the Government's desire to redirect effort to more lightly fished offshore pelagic species. Of special interest is the proposed new monitoring system for offshore operations. The issue of fish pots captured much of the public attention in fisheries during the 1990s. There are a few Bermudians, however, who are interested in Bermuda's potential for longlining. Minister Hodgson has said that he is hopeful that building a domestic longline fishery is an achievable goal.[252]

F. Promotion

The Government has been encouraging the fishermen, who once mostly set pots to diversify. One of the areas suggested by DAF is longlining. The Government since 1980 has conducted or sponsored trial fishing to assess the potential for a Bermuda longline fishery. The longline fishery, however, requires considerable expertise and a substantial investment. It is not yet a major fishing method in Bermuda. One local observer reports that several factors discourage Bermudian fishermen from taking up longlining.

Expenses: Only a few Bermudians have purchased longliners and initiated operations and they have generally done so with only limited personal experience with longlining.

Technology: Fishing is a very traditional activity in Bermuda with fathers teaching sons. There are, however, no fishery training schools and few Bermudians are knowledgeable about longlining.
Investment: A relatively substantial investment is required for longlining. Those young people entering the industry are generally interested in more profitable recreational charter boats.[253]
Alternatives: Many young Bermudians see more opportunity in tourism, banking, and other sectors besides fishing.

Bermuda officials are hopeful that experiences with Canadian and U.S. fishermen during the 1990s as well as test fishing promoted by the DAF has helped acquaint Bermudians with longline operations. Little was learned from the Taiwan longline fishermen. Officials describe them as "tough operations" and Bermudian fishermen had little interest in working on these vessels. The Canadian longliners working out of Bermuda in 1994 were more useful in introducing longline fishing to Bermudians. Several Bermudians have now been involved with the test fishing and charter boats, acquiring experience with long line operations. Officials in 2000 point to one small, but successful longline operation conducted by Robert Lambe aboard the *Ark Angel* and are hopeful that other such operations will follow.[254]

The Government does not provide low interest loans for fisheries development as is the case on several Caribbean islands. The fishing industry is a very traditional activity on Bermuda and is largely self financing.[255] The fishermen obtain some financing from private banks, the Bank of Bermuda and the N.T. Butterfield Bank. These banks have made small loans to finance small scale fishermen.
Bank of Bermuda: The Bank of Bermuda has made small loans to fishermen to purchase small boats and equipment. They have not made any loans to purchase commercial vessels.
N.T. Butterfield Bank: The N.T. Butterfield Bank is the oldest bank on Bermuda and has operated since 1858. They make small loans to fishermen. Most of the loans are for charter boats used in the recreational fishery. The Bank made six such loans in 1999.[256]

G. Development options

A variety of options are available to Bermuda, but there is a wide range of opinions on the island as to how to proceed. Bermuda officials are currently assessing the available options to determine the best use their EEZ. There is considerable difference of opinion on the island, even within the fishing industry.

1. Fishing industry

Artisanal fishermen are fearful that longlining will impair their operations. There is a "protectionist" attitude among many artisanal fishermen who object to commercial development such as longlining.[257] They are especially concerned when they see large boats, even though the boats may work away from their grounds on species they do not target. Officials have sought to allay their concerns by establishing a coastal exclusion zone to prevent gear conflicts. Artisanal fishermen are also concerned about competition on the market place with longline-caught fish. Often rumors swirl around the artisanal fishing community with appearance of large foreign vessels like the Cuban longliner *Jurel*. Some fishermen claimed inaccurately that the foreign vessels had access to duty free fuel.[258]

Recreational fishermen are concerned that longlining will reduce billfish stocks. Recreational fishermen include both Bermudians sport fishermen and the charter boat operators. These fishermen share what Government officials refer to as the "protectionist attitude" of the artisanal fishermen.[259] The recreational fishermen often point to the U.S. ban on landing Atlantic billfish and the Bahamas decision to discourage longlining. Recreational fishermen insist that sports fishing generate more revenue and creates more jobs, often good paying jobs, then longlining offers and can do so without depleting the billfish stock.[260] Bermuda officials point out that the Bahamian policy on longlining is often oversimplified and was never purely a matter of protecting billfish.[261]

Even among those interested in investing in longlining and BIU union representatives there are differences. Some believe longlining should be conducted solely by Bermuda fishermen. Others think that, at least initially, there are advantages to chartering foreign longliners. Some want the Government to strictly limit the fishery to Bermudians. Others point out that the longline fishery is labor intensive and that foreign fishermen can provide both investment capital and needed technology. The debate often resolves around the terms of access, with various conditions and time constraints being suggested. Many believe that foreign vessels could be used as a platform for training Bermudians. Others believe that leasing arrangements, such as the controversial leasing of the Cuban longliner *Jurel*, offer nothing to the Bermuda fishing industry. Government officials believe that vessel charters at this time are the most cost-effective means of entering the fishery and are concerned about ICCAT discussions about chartering arrangements which could lead to

prohibitions.[262]

2. Environmental and civic groups

Some environmental and civic groups question whether any type of fishing, except artisanal fishing, should be conducted in the EEZ and are promoting the establishment of a marine preserve.

Bermuda Zoological Society (BZS): The BZS has developed a theme highlighed by the Report of a Commission of Inquiry.[263] They suggest declaring the 200-mile EEZ a marine preserve where no "industrial" fishing is allowed. The term industrial is used as Americans would commercial, but excludes the small-scale artisanal fishermen. The Society believes that such a step would "... dramatically promote Bermuda's image as an environmentally sensitive location."

Bermuda Chamber of Commerce (BCC): The BCC also supports the BZS proposal. The BCC, of course strongly influenced by the island's important tourist industry, suggests that such a marine preserve could position Bermuda at the forefront of ecotourism for the 21st century. Fishery officials point out their concern that such a preserve may create international difficulties in that the Law of the Sea Treaty (UNCLOS) requires countries not utilizing resources within its EEZ to make them available to other countries.[264]

XIV. Research

Two Bermuda groups conduct fisheries and related oceanographic research.

BA: The Bermuda Aquarium is conducting important research on turtles. They coordinate the recovery and rehabilitation of stranded sea turtles and document turtle mortalities. The BA has substantiated turtle interactions with longlines. The BA's work with a standing network is helping to compile data on turtle mortalities that will help assess the importance of various causes of turtle mortalities.[265]

BBSR: The principal biological research institute on Bermuda is the Bermuda Biological Station for Research (BBSR) located at St. George's West. The Station has an important marine program including both research and education which focuses primarily on the inshore species of interest to local fishermen. Research on offshore pelagics until the 1990s was extremely limited.[266] The authors know of no research currently underway at the Station on swordfish or other oceanic pelagics.

DF/DAF: The Fisheries Division (FD) of the Department of Agriculture and Fisheries (DAF) plays a major role in Bermudian fisheries research. DAF acquired a 15-m research vessel from the United States in 1980.[267] The DAF has collected statistics on fisheries catches reported by domestic and licensed foreign fishermen. The DAF participates in the ICCAT Enhanced Program for Billfish Research. Research on age-growth and reproductive aspects of pelagic species is ongoing. Shore-based sampling of the artisanal pelagic fleet for size and sex data has been conducted.[268] Bermuda also provided billfish samples to ICCAT researchers.[269] The DAF also engages in several regional research programs on pelagic species.[270] The DAF has provided samples of blue marlin otoliths to ICCAT researchers.[271] There are no DAF studies specifically focusing on swordfish or recreational fisheries.[272] The DAF did cooperate with a British researcher in a recent

Photo 23.--The Bermuda Biological Station for Research is the island's principal biological research institute. They have a research vessel the R/V "Weatherbird II". Helle Patterson

assessment of the recreational fishery.[273]

While there has been little scientific assessment of swordfish off Bermuda, the Bermuda Government has sponsored test fishing to assess the potential for swordfish and other pelagic fisheries. The DAF research vessel, the R/V *Calamus* has taken swordfish with experimental longlines.[274] The first test fishing was conducted with FAO assistance in the early 1980s.[275] (See "International: Foreign Aid".) A U.S. longliner was granted a special permit in 1983. (See "International: Relations".) The DAF in 1988 again used the *R/V Calamus* for test fishing using monofilament longline to target yellowfin. The DAF conducted more trials with the *R/V Calamus* in 1989. The DAF also arranged for International Tuna Traders Ltd. to deploy its longliner for 2-weeks. Poor weather hampered operations, but it afforded the opportunity for local fishermen to observe the operation of a purpose-built longliner. The FD in 1990-92 continued to experiment with longlining, but these trials were eventually concluded because of financial constraints and a lack of interest on the part of the fishermen. A U.K.-based spark plug firm in 1993 arranged for a special permit to be granted the U.S. longliner *Anna C.*[276] The U.S. fishermen achieved notable catches of swordfish and bigeye tuna before withdrawing because of a dispute with the permit holder. The Government in 1994 granted licenses to seven Canadian longliners. While eventually curtailed by Canadian authorities, the Canadian operations provided a substantial volume of data on the abundance of pelagic resources in the EEZ as well as an opportunity for Bermuda fishermen to gain valuable experience.[277]

Some foreign researchers have also been active on Bermuda.

UN: A researcher at the University of Newcastle in the United Kingdom hosted by the BBSR prepared a detailed assessment of the recreational fishery in 1999.[278]

UM: Researchers at the University of Miami involved with genetic work on billfish and swordfish are interested in Bermuda samples. The UM researchers are also interested in Barbados samples because billfish tagged off Florida have been taken off Barbados. As Bermudian researchers have not done billfish sampling work, the UM has requested permission to sample in Bermudian waters.[279] The Bermudian Government is studying the request.

VIMS: The Virginia Institute of Marine Science (VIMS) is planning to use archival "pop-up" tags to learn more about marlin behavior and migration patterns. VIMS plans to use Bermudian longliners for their work.[280]

Bermudian researchers have worked on some bycatch species. The Caribbean Conservation Corporation (CCC) and the DAF initiated a turtle research program in 1968 which involved catching turtles with a large entrapment net and tagging them to study distribution, migration, and growth patterns. The DAF and the BBSR have reported continued work catching, tagging, and releasing turtles, as well as issuing permits to the local aquarium, museum, and zoo for turtle research. This program continues today as a cooperative effort of the Bermuda Aquarium, Museum and Zoo, DAF, and the CCC. Studies focus on the green turtle and the hawksbill and address population biology, life histories, habitat use, genetic identity, and migrations.[281]

XV. Bycatch

Bermudian fishermen have not yet managed to launch a viable pelagic longline fishery targeting swordfish and tuna. As a result, there has been no significant bycatch. Bermudian fishermen have, however, begun to conduct longline operations, and swordfish catches have been reported since 1995. As a result, it is likely that Bermudian longline catches and thus bycatch will be limited for the foreseeable future.

Bycatches from the foreign fishermen operating off Bermuda have been much more important than the local operations. Little information is available, however, on the bycatch reported by the foreign fishermen. Bermuda does not require at sea observers. Shore inspections are not possible with the Taiwan operations as the fishermen rarely land fish in Bermuda or call at Bermuda ports. Observers aboard Canadian vessels were more practical as the Canadians operate out of St. George's. U.S. fishermen do participate in an observer program, but coverage is very limited.

Some information is available on the species affected by swordfish and other pelagic fisheries.

A. Tuna

The Taiwan longliners operating in and around Bermuda reported a substantial tuna catch. Data for six licensed longliners in 1991 show that about 35 percent of the catch was tuna, mostly albacore and yellowfin (appendix B7).[282]

B. Billfish

The Taiwan longliners operating in and around Bermuda showed a surprisingly large billfish catch. Data for six licensed longliners in 1991 show that about 30 percent of the catch was marlin (appendix B7).[283] This is a very high billfish bycatch, much higher than normally reported by longliners that are not targeting the species. The marlin catch almost equalled the tuna catch. The marlin species that the Taiwan fishermen are taking is probably blue marlin. White marlin is generally more coastal and in more shallow waters than blue marlin. The Taiwan fishermen operating offshore in deeper waters would thus most likely be taking blue marlins. In addition Bermuda fishermen report much higher catches of blue than white marlin (appendix B2b).

Local commercial fishermen do not target marlin and other billfish, although this may change if Bermudian fishermen succeed in launching a local longline fishery. There is currently no market for billfish on Bermuda and it is not offered on hotel and restaurant menus.[284] DAF officials report that there was some directed fishing for marlin in the 1970s and early 80s, but that a strong conservation movement succeeded in convincing fishermen to tag and release marlins.[285] Marlins are taken mostly by the recreational fishermen. The DAF estimates that 80-90 percent are taken by the recreational fishermen.[286] Marlins have mostly been taken incidentally in the troll fishery, but even these fish are usually tagged and released.[287]

The development of a longline fishery in Bermuda would presumably increase the domestic marlin catch. The predominate species taken by the recreational and commercial fishermen is blue marlin.[288] The total commercial and recreational blue marlin catch in Bermuda until 1997 varied during the 1990s from 11-19 t annually (appendix B2b). Since 1997, blue marlin catches have dropped sharply. White marlin catches are normally 1-2 tons.[289] Blue marlin catches while fluctuating since 1975 have increased substantially. Yields since 1988, however, have declined markedly. One assessment suggests a decline of about 50 percent.[290] The Cuban longliner *Jurel* leased by Seamont reported catches of marlin and spearfish (appendix B6b). The spearfish catches were notable as it is a species that is not often taken in such quantities.

C. Sharks

The Bermuda Government in 1995 reported modest shark bycatches to ICCAT. Bermuda reported 15 t of shark bycatch including 2 t of tiger sharks.[291] The Canadian longliner *Alexis I* operating out of Bermuda in 1995-98 landed small quantities of makos (appendix B3a). The Cuban longliner *Jurel* which landed fish in Bermuda during 1998-99 reported very high shark bycatches, which they landed or attempted to land in Bermuda. Landings on some trips were over 80 percent shark.[292] Species landed included bigeye thresher, blacktip, blue, hammerheads, mackerel, mako, tiger, and white tip. Data available from the Cuban landings indicated very large number of blue sharks on one trip (appendix B3b). The only shark species wanted by the company leasing the *Jurel* was the makos so this may have affected what the Cuban fishermen landed--although Seamont officials complain that the Cuban captain paid little attention to their instructions.[293] An observer from a U.S. university aboard the Bermuda longliner *Ark Angel* in 2000 reported catching 10 blue and 5 Galapagos sharks during 4 night sets for swordfish.[294]

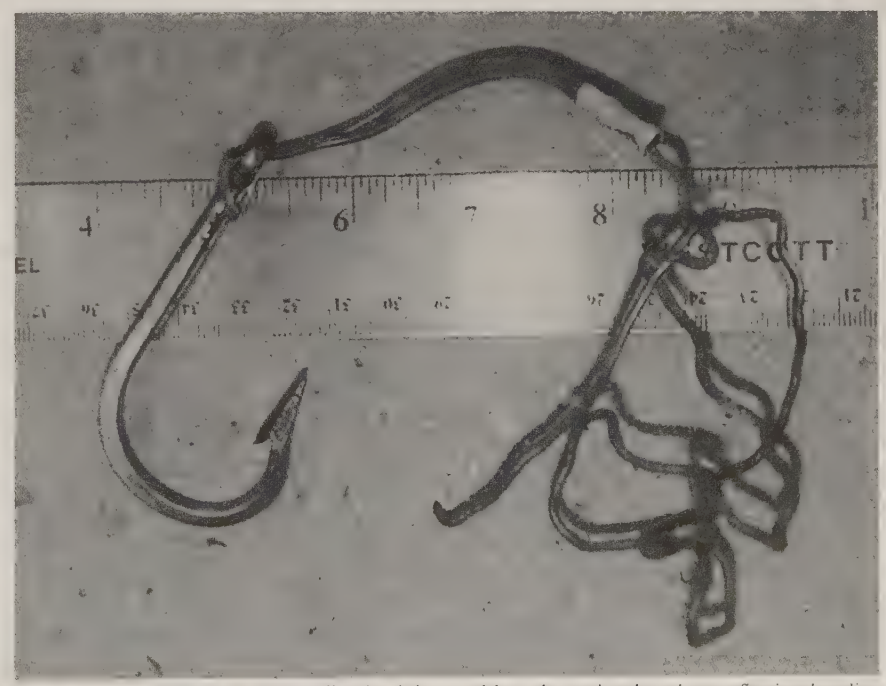

Photo 24.--The BA found this longline hook ingested by a loggerhead turtle, confirming longline interactions. Researchers are working to quantify the levels of these interactions. Peter Meylan

Figure 10.--Green turtles tagged off Bermuda have been recovered at sites throughout the Caribbean, especially the western Caribbean islands and coast of Nicaragua. CCC

D. Other finfish

Two species taken by longliners off Bermuda are very important to the country's commercial fishery. The most important is wahoo which since the mid-1980s has been the mainstay of the commercial fishery. Dorado ("dolphinfish") is also important to the local fishery.[295]

E. Turtles

The regulation of sea turtle harvesting is almost as old as Bermuda itself. Bermuda first protected sea turtles in 1620 with what Bermudian officials assert may have been the Western Hemisphere's first environmental legislation.[296] A long list of protective measures ensued which, however, ultimately proved unsuccessful. The nesting population was driven to extinction although there is still a foraging population. Bermuda turtling primarily focused on green turtles (*Chelonia mydas*) which were netted. The fishery was not completely closed until 1972.[297] The initial ban was for 5 years, but has since been renewed. Violations can result in fines of up to $4,000 and 2 years in prison.[298] The 1978 Fisheries Protected Species Order extended the ban throughout Bermuda's 200-mile EFZ. Bermuda officials have enlisting public support and international cooperation to protect and perhaps someday reestablish the islands' sea turtle population.

Sea turtles are found in Bermudian waters, but exploitation of the nests virtually wiped out the islands' nesting populations by the 1930s. The DAF and the Caribbean Conservation Corporation (CCC) in the 1960s and 70s experimented with a restocking program that involved the introduction of green turtle eggs from Costa Rica. Through an informal agreement, Costa Rica supplied eggs which the FD and private citizens stocked several Bermuda beaches. The hope was that this would help to reestablish a nesting population on Bermuda. As of 2000, however, no green turtle nesting has been documented. The fact that green turtles may require 20 years or more to reach sexual maturity may mean that the experiment has not had enough time to produce results.[299] Researchers are, however, becoming less optimistic with each passing year without any documented nesting. Bermuda officials have not yet given up on the project.[300] Fisheries Director Dr. James Burnett-Herkes indicated in 1979 that he saw construction of beach front hotels and other tourist facilities as the greatest danger to turtles and other threatened marine wildlife.[301]

Photo 25.--While turtles are protected in most Caribbean countries, large numbers are being harvested for subsistence along the coast of Nicaragua and offshore islands. Lamarr Trott

Five species of sea turtles have been observed off Bermuda, although only two (leatherbacks and Kemp's Ridleys are rarely reported). Almost all of the turtles found off Bermuda are juveniles. Researchers speculate that the waters around Bermuda especially the Sargaso Sea may serve as a developmental habitat, or nursery, for greens and hawksbills. All individuals of these two species that have been examined as part of the Bermuda Turtle Project have been immature.[302]

Greens: Green turtles are the predominate sea turtle species found off Bermuda. Bermuda hosts one of the densest aggregations of juvenile green turtles in the world. All appear to be immature, ranging in size from 21-81 cm straight carapace length. They forage on the abundant seagrass beds around the island. Juveniles are often found feeding in sea grass pastures along Bermuda's coral reefs.[303] Genetic studies indicate that the green turtles off Bermuda hatched on Florida, Mexico, Costa Rica, Venezuela (Aves Island), Suriname, and a population that nests at several south Atlantic sites.[304] Tag returns and satellite tracking data from the Bermuda turtle Project indicate that the larger turtles eventually depart Bermuda for feeding grounds throughout the Caribbean, with the majority traveling to the grass beds off Nicaragua (figure 10).[305] While protected off Bermuda, substantial numbers of these turtles are harvested for subsistence along the Nicaraguan coast and offshore islands.[306] Cuban fishermen also take them in some numbers.[307] Cuban authorities substantially reduced the turtle catch in the 1990s, but still allow some turtle fishing. [308]

Hawksbills: Hawksbills are occasionally captured by sea turtle researchers, but most often seen by recreational divers looking for lobsters. These turtles live in close association with coral reefs where they feed on sponges.[309]

Loggerheads: The first loggerhead nest was discovered in 1990 and was the first turtle nest reported on Bermuda since the 1930s. A number of juveniles are found stranded during the winter, washed in by storms.

Leatherbacks: Leatherbacks occasionally pass through Bermuda waters, but they do not appear to reside on the platform. Only small numbers have been reported, primarily as a result of entanglements. Entanglement in buoy lines marking fish and lobster pots has been documented as a source of mortality in Bermuda waters.[310] The Government's 1990 pot ban, however, has removed this as a continuing problem.

Kemp's Ridleys: The critically endangered Kemp's Ridley is usually found in the Gulf of Mexico and southeastern U.S. coast. Occasionally immature individuals are observed off Bermuda, but only a few records document the occurrence of this species.[311]

Bermudian researchers have done considerable work on turtles.[312] The Bermuda Sea Turtle Project has studied sea turtles in the coastal waters off Bermuda and tagged them. As there is no significant nesting on Bermuda, the work has been conducted at sea. Over 2,000 turtles have been captured, studied, and tagged.[313] The in-water capture and tagging program that is conducted in Bermuda is one of the longest-running marine turtle research program in the world. Over 2,000 turtles have been captured and studied since 1968.[314] Recreational fishermen provide differing accounts on the abundance of turtles off Bermuda. Some report rarely seeing turtles.[315] Others see them more commonly.[316]

The authors know, however, of no detailed Bermudian assessment of longline or other fishery interactions with turtles. There is, however, some

available information.

Ark Angel: An observer from a U.S. university aboard the Bermuda longliner *Ark Angel* in 2000 noted no interactions with turtles, although a very small number of sets were observed.[317]

Bermuda Aquarium: The Bermuda Aquarium also coordinates the recovery and documentation of dead and debilitated sea turtles in Bermuda. A number of mortality factors have been identified, including boat collisions, entanglement in nets and fishing lines, and interactions with the longline fishery. A female subadult loggerhead turtle necropsied in August 2000 had a longline hook in its esophagus and a twisted and necrotic digestive track. The extent of longline interactions with turtles around Bermuda has not been quantified, but this information is likely to become available with the increasing numbers of stranded turtles that are necropsied by the stranding network.[318]

Other: Entanglements with discarded gear have been reported.[319]

U.S. observers: The observers on U.S. longliners operating west and north of Bermuda provide some comparative data on the possible longline interactions. The species most affected by longlines appear to be loggerheads and leatherbacks. NMFS is particularly concerned about interactions in the Grand Banks (Caribbean Overview, appendix G1b1).[320]

There is considerable interest in turtles on Bermuda by the public and environmental community. Recreational fishermen have in fact saved turtles entangled in fishing gear.[321]

F. Marine mammals

Bermuda has a considerable history of commercial whaling, based primarily on the seasonal migrations of humpbacks. The last known whale was taken in the 1930s. The Bermuda Government in 1978 placed whales and other marine mammals on the Bermuda Fisheries (Protected Species) Order. Officials note that this effectively makes the Bermuda EEZ a whale sanctuary. The tourist industry has capitalized on this. Whale watching has become a popular ecotourism attraction during the spring migration. Numerous whale watching operations are available to tourists. The DAF has prepared guidelines for whale watching operators to reduce harassment of the animals.[322]

Recreational fishermen seasonally report sightings of marine mammals, including humpback whales, sperm whales, and various dolphins and porpoises.[323] An observer from a U.S. university aboard the Bermuda longliner *Ark Angel* in 2000 observed some porpoises at a distance, but noted no interactions with the longline sets. [324]

G. Seabirds

The authors have little information about fishery interactions with seabirds. An observer from a U.S. university aboard the Bermuda longliner *Ark Angel* in 2000 noted no interactions with seabirds.[325] More information is available on bird populations. The Audubon shearwater is a wide-spread pelagic bird with several subspecies. Two subspecies have breeding populations confined to the wider-Caribbean, including the Bahamas.[326] Caribbean populations appear to be declining. Population declines have been reported on islands off Puerto Rico.[327] The species has been recently reported to be extinct as a breeder on Bermuda.[328]

XVI. International

A. International relations

1. Multilateral

The principal multilateral organization that has been involved with Bermudian fisheries has been the International Commission for the Conservation of Atlantic Tunas (ICCAT). ICCAT is responsible for international coordination of research on and management of tuna and tuna-like species in the Atlantic, including swordfish. ICCAT has established catch limits and a variety of other conservation and management measures for many of the species under its purview. As a U.K. Overseas Territory, Bermuda's interests are represented by the United Kingdom which is an ICCAT member.

Bermuda officials for some time considered the possibility of asking the U.K. to join ICCAT on their behalf.[329] The United Kingdom joined ICCAT in 1995, reportedly because of the interest of Bermudian officials. Bermuda had participated in the negotiations resulting in the creation of ICCAT in 1966 and followed the Commissions activities. Only recently did Bermuda concluded that it needed to participate more fully in ICCAT proceedings. The passage of the Law of the Seas Treaty and other international initiatives like the United Nations sponsored agreement on highly migratory and straddling fish stocks gave increasing importance to regional bodies like ICCAT. These developments convinced Bermuda officials that greater participation in ICCAT was needed. Individual European Union members, like the United Kingdom, however, are no longer ICCAT members representing their fishermen directly. It was agreed at the 1997 annual ICCAT meeting that all EU Member States would withdraw from ICCAT effective December 31, 1997. The sole exceptions were France and the United Kingdom which then rejoined in respect of their overseas territories.[330]

The U.K. interest in ICCAT in past years has primarily focused on Bermuda and St. Helena. The United Kingdom on the behalf of Bermuda sought and received quotas for both north Atlantic swordfish and western Atlantic bluefin tuna. Bermuda officials cooperate with the ICCAT by supplying data and have indicated some interest in participating in Commission programs.[331] Prior to the United Kingdom joining ICCAT on behalf of Bermuda, Fisheries Director, John Barnes, in 1994 responded to questions concerning licenses issued to Canadian swordfish fishermen allowing them to fish in the Bermuda 200-mile EFZ. ICCAT member countries, as well as Canadian officials themselves, expressed concern that Canadian fishermen were conducting operations from Bermuda as a way of fishing beyond their country's quota, thus impairing the ICCAT management program. Barnes replied that Bermuda, as it was not at the time a member of ICCAT, was not bound by ICCAT quotas and regulations and thus "we didn't violate anything" by licensing the Canadians.[332] Canadian officials subsequently took legal action to insure that its fishermen did not continue such operations.

Bermuda has decided to expand participation in ICCAT. John Barnes agreed to serve as Chairman of the exceedingly difficult Panel 2 (bluefin tuna and northern albacore) for a 2-year term.[333] ICCAT at its 1997 meeting provided a 28 t allocation to the United Kingdom on behalf of Bermuda (Caribbean overview, appendix H3b). This quota was subject to percentage reductions consistent with reductions required of other ICCAT members through 1999.Bermuda's swordfish quota in 1999 was thus reduced to 27 tons and the nature of the quota was altered.

At the 1999 ICCAT meeting, the quota previously provided to the United Kingdom specifically for Bermuda was changed to a general allocation for U.K. Overseas Territories (OT). This change was instituted at the United Kingdom's request. Bermuda officials see some difficulties in being represented by the United Kingdom in that it is not a "mainline player" in ICCAT.[334] Bermuda will likely have to share the U.K. Overseas Territories quota with the other Overseas Territories such as Anguilla and the British Virgin Islands which also land small quantities of swordfish.[335] Environment Minister Arthur Hodgson in his report to the House of Assembly concerning 1999 changes to the ICCAT management regime seemed supportive of international fishery measures.[336] It is not known at this time how the United Kingdom plans to allocate its quota among other its Overseas Territories with small longline fisheries. Bermuda officials foresee the need for some internal negotiating among the OTs.[337] Several U.K. OT such as Anguilla, British Virgin Islands, and Turks and Caicos have expressed an interest in a share of the OT allocations (Caribbean Overview, appendix H3b). This will probably occur at a coordinating meeting held in the United Kingdom before the annual ICCAT meeting where allocations are discussed.[338]

The United Kingdom OT allocation was set at an annual north Atlantic swordfish allocation for 2000-2002 of 24 tons (Caribbean Overview, appendix H3b).

Bermuda officials would like to increase their small quota, but recognize that the main "stumbling block" has been the inability of the Bermuda fleet to catch even the small quantity allocated.[339]

Bermuda officials have expressed concerned over two issues currently under consideration at ICCAT.
Vessel charters: ICCAT discussions of vessel charters are a particular concern. Bermuda officials view such charters as the most cost-effective means at this time of exploiting their EEZ and are thus concerned that ICCAT may attempt to prohibit such charters.[340]
Fee structure: Bermuda officials are also concerned about changes in the ICCAT fee structure which may significantly increase the Bermuda contribution.[341]

2. Bilateral

Bermuda's principal bilateral fishery relations are with the foreign fishermen desiring to longline off the island. As the local fishermen primarily fish close to the island or on nearby banks, there are generally few interactions with the longliners operating offshore. The local fishermen only occasionally see the foreign longliners.[342] As part of the licensing arrangement, Bermuda has required the licensed longliners to operate outside of a 50-mile coastal zone within the EFZ. As Bermuda, until recently, has had no longline fleet, the foreign longliners did not compete with local fishermen. Swordfish is not the target species of the foreign longliners, but in years in which large numbers of foreign longliners were licensed, there has been a substantial swordfish bycatch (appendices D1a-d). Data on Bermuda's foreign licensing program, however, has not been authorized for public release.[343] The authors are unsure as to why this information has not been released to the public.[344]

Foreign fishermen operating in Bermuda waters have caught some fish. The primary foreign country involved is Taiwan, but the U.S. and Canadian reported some effort in 1993-95. Specific details on swordfish catches for Bermuda-based fishermen over the last 5 years are not available. However, the average annual landings of pelagics (including swordfish) is approximately 160 tons.[345]
Canada: Bermuda officials in 1994 licensed seven Canadian longliners to fish in offshore waters. Some of the vessels were also apparently active in 1993. Unconfirmed reports indicate that the Canadians landed their catches fresh at St. George and air shipped them to the United States. Bermuda officials, however, insist that this was not the case. While the vessels did operate out St. George, Bermuda officials believe that the Canadian fish went to Canada and not the United States.[346] The authors can not determine the disposition of the Canadian fish, but note that U.S. import data do show shipments to the United States in 1993-94 (appendix E2a1). Bermuda officials believe that the U.S. trade data is erroneous.[347] The Canadians supplied a substantial volume of data on the abundance of pelagic fish in the EEZ and a chance for Bermuda fishermen to experience longline operations firsthand.[348] Bermuda officials were pleased with the Canadian interest because the Canadian operations provided spin-off economic benefits to Bermuda agents, freight-forwarders, and workers. It also generated some income from services to the fishermen while in port. The Canadians also agreed to hire two Bermudian fishermen per vessel so that they could receive some training in offshore fisheries.[349] Local fishermen complained, however, that the Canadians only hired one Bermuda fishermen per boat. They charge that the Canadian interest was simply because they had exhausted their quota off Canada and wanted to continue fishing.[350] The Canadians caught 3-4 t of bluefin tuna and 12 t of swordfish as a result of their Bermuda operations during the winter of 1993-94.[351] The Canadian Department of Fisheries and Oceans (DFO) subsequently warned Canadian fishermen against fishing outside Canadian waters or reflagging their vessels in an effort to avoid Canadian fishing regulations. The DFO has threatened prosecution and the possible loss of rights to Canadian licenses. Canada has seized at least one of its own vessels operating out of Bermuda, but beyond Bermuda's 200-mile EFZ.[352] The Canadian Government was reportedly considering a new license for extra-territorial fishing. Press reports, however, indicate that Bermuda officials continue to encourage the Canadians to apply for licenses and are annoyed with the Canadian Government's handling of the affair.[353] Bermuda and Canadian officials in 1994 informally discussed possible fishing arrangements. Bermuda officials have reportedly suggested setting up a joint company to conduct tuna and swordfish operations out of Bermuda. Recent reports from Canada suggest that renewed Canadian operations out of Bermuda are unlikely. The Canadian Government formally prohibited Canadian fishing outside of Canadian waters unless specifically licensed by the Canadian Government to do so.[354] Informal inquiries from the Nova Scotia Department of Fisheries suggest that it is highly unlikely that the Canadian Federal Government will grant such licenses to Canadian fishermen.[355] A Bermuda company in 1996 leased the Canadian longliner *Alexis I* to supply fish to the domestic Bermuda market. The Canadian longliner operating successfully through early 1998, but maintenance costs were reportedly high on this older vessel.[356]
Cuba: The Flota Atunera de Cuba (FAC) has not

purchased Bermuda licenses. FAC has not deployed its longliners off Bermuda (Caribbean Overview, appendix D3), with one exception. A Bermuda company, Seamont Fisheries, leased the Cuban longliner *Jurel* to operate out of Bermuda beginning in 1998.[357] Unlike the licensed foreign longliners, the Cuban vessel was authorized to land its catch in Bermuda for sale on the local market. Catches of swordfish, tuna, and shark were landed and sold on the island.[358] The Bermuda businessman chartering the boat reports limited swordfish catches by the Cubans. After one trip the Cubans landed 0.9 t of swordfish and no swordfish on another trip. The Cubans did, however, land very large quantities of shark (appendix B6b).[359] The *Jurel* operated during 1998-99, but the fishing license was not renewed because the aging Cuban longliner proved expensive to operate and landed excessive amounts of shark, a species not in demand on Bermuda.[360]

Faroese Islands (Denmark): Two Faroese vessels, including the *Bakur,* purchased Bermuda licenses in 1979 (appendix D2b). The longliners targeted tuna and sharks and did some test fishing for tunas, marlin, and swordfish.[361]

Japan: While Japan does not fish extensively in the Caribbean, it does operate longliners in the western north Atlantic, north of 30°N. This includes areas around Bermuda.[362] Japan appears to license few longliners in Bermuda (appendix D2b). Nichirei, a Japanese company based in St. Maarten (Netherlands Antilles), according to a 1979 report, chartered many of the Taiwan and Korean vessels that were licensed in Bermuda (appendix D2b).[363] Nichirei continued licensing Taiwan longliners it chartered during the 1980s and early 1990s. Bermudian officials complained about the difficulty collecting data from the Asian vessels licensed. The Japanese company contracting these vessels agreed to require more attention to the submission of the required data.[364]

Korea: Korean (ROK) officials expressed an interest during the mid-1970s in obtaining port privileges and possibly building shore facilities in St. George.[365] Several Korean vessels, reportedly under charter to a Japanese company based in St. Maarten, purchased Bermudian licenses during the late 1970s (appendix D2b).[366]

Spain: The Spanish longline fishery began moving into central Atlantic waters during the mid-1980s. The Spanish still operated well east of Bermuda EEZ.[367] There have been reports, however, of Spanish transshipment through Bermuda.[368]

Taiwan: Taiwan, like the Japanese, initiated Caribbean-area longline operations in the 1960s. The primary Taiwan activity has been to the north of the Caribbean, as far as Bermuda, where they have targeted albacore to supply Puerto Rican canneries packing "white meat" tuna. Many of the vessels have operated out of St. Maarten.[369] Available evidence suggests that Taiwan longliners are not extensively fishing Caribbean waters, but are using Caribbean ports to transship their catch and maintain their fleet. Taiwan vessels in the mid-1980s also began expanding transshipping activities out of Port-of-Spain.[370] The vessels, however, do not appear to be the longliners targeting albacore to the north of the Caribbean. Taiwan longline fishermen based in St. Maarten have been the primary foreign fishermen purchasing Bermudian offshore licenses. The number of vessels involved in the fishery have varied. DAF officials report that 33 Taiwan longliners were active in 1987 (appendix D2a).[371] The number of licensed Taiwan vessels peaked in 1991.[372] The authors believe that about 10 Taiwan vessels purchased Bermuda licenses in 1994. Taiwan activity off Bermuda was primarily targeting albacore. Their operations have declined as the fleet increasingly targeted bigeye in tropical waters rather than albacore off the more northerly latitudes around Bermuda.[373] The Taiwan fishermen rarely landed fish in Bermuda. According to Bermuda officials, however, the Taiwan fishermen keep sloppy log and catch records. Bermuda officials express some concern that the Taiwan fishermen do not provide any other economic benefit to Bermuda except for the payment of the licensing fee.[374] While the Taiwan fishermen did not target swordfish, the size of the operation resulted in a substantial swordfish bycatch (appendix D1c).

United States: The United States began developing a longline fleet targeting yellowfin tuna in the Gulf of Mexico. Beginning in the mid-1980s, U.S. longline fishermen began targeting swordfish after commercial stocks were encountered off the Florida Atlantic coast.[375] U.S. fishermen have reportedly in the past purchased a few Bermudian offshore fishing licenses. Bermuda officials report, however, only one of those vessels actually fished as part of a "joint experiment".[376] Bermuda officials in 1983 granted a special permit to the U.S. longliner *Olympic Star* to carry out exploratory longlining for swordfish in Bermuda's EEZ. The vessel was required to carry a FD observer and make provision for Bermuda fishermen. Only one local fisherman, however, took advantage of this offer. Sets were conducted in December yielding 37 swordfish during 9 sets with a 40-km line. The U.S. fisherman involved judged this as a generally poor result.[377] No U.S. fishermen are currently licensed for offshore operations, but Bermuda officials indicate that they have received inquiries from U.S. fishermen. U.S. fishermen do occasionally fish the area around Bermuda, but the level of activity varies significantly from year to year.[378] U.S. catches in the area have been very limited.[379]

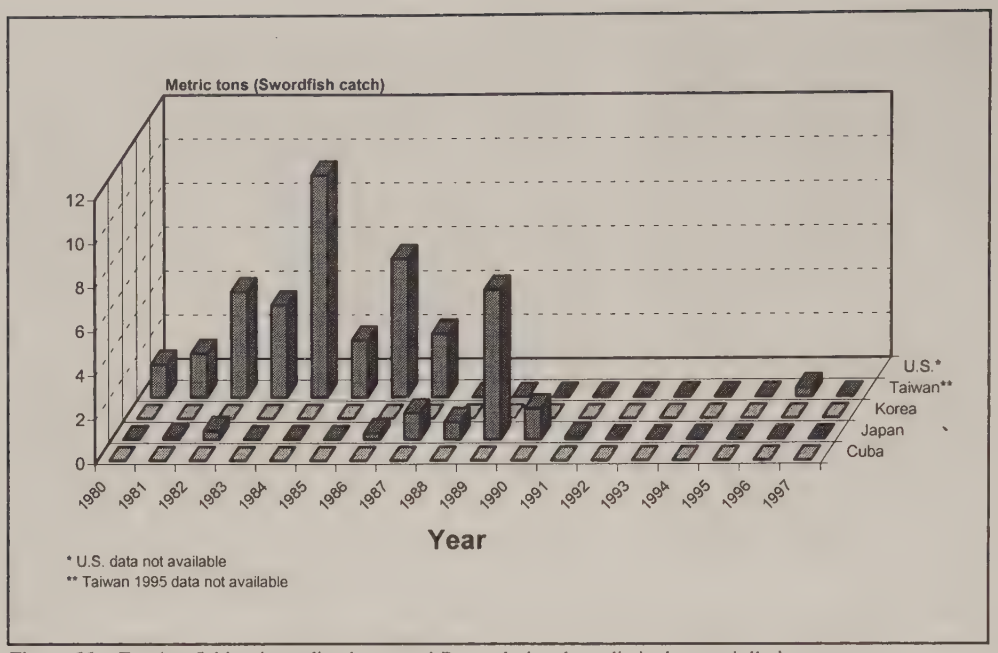

Figure 11.--Foreign fishing immediately around Bermuda has been limited, especially in recent years.

Catches to the west of Bermuda in the U.S. EEZ are substantial as the U.S. fleet concentrates its effort along the Gulf Stream and the edge of the continental shelf.
USSR: Soviet officials expressed an interest during the 1960s and mid-1970s in obtaining port privileges and possibly building shore facilities at St. Georges.[380]

B. Joint ventures

The authors know of no joint venture companies handling swordfish. Some Bermuda companies have chartered foreign longliners. Bermudian officials have expressed an interest in mutually beneficial joint venture projects.[381] Foreign companies in the past set up offices in Bermuda to coordinate the operations of their vessels working with Bermuda licenses. In most cases little onshore investment is involved.
Canada: Bystartan Seafoods in Halifax was active during the 1970s. Bermuda officials in 1994 reportedly suggested a possible joint venture to Canadian officials.
Cuba: The chartering of the Cuban longliner *Jurel* in 1999-2000 may be referred to as a joint venture. The arrangement was, however, a straight charter contract.[382]
Korea: Korean and Bermudian officials discussed a possible fisheries joint venture in 1974. The Koreans were considering a possible Bermuda base for fishing vessels operating in the Atlantic. The Koreans offered possible fisheries development assistance.[383] No such agreement, however, was ever reached.
Other countries: Other foreign companies active in Bermuda have included Angela Ltd., Jasna Ltd., and Vida Ltd., but details on the nationality of these companies are unavailable.

C. Foreign aid

Bermuda obtained UNDP funding and FAO technical assistance in the 1970s for a fisheries development project. The UNDP in 1975 financed a private consultant to formulate a fisheries development program. The Department of Agriculture and Fisheries worked with FAO to develop a test longlining project. Bermuda obtained a fisheries research vessel, the *R/V Calamus*, and in June 1981 was deployed with a FAO masterfisherman.[384] The focus of the project was to develop fisheries and local markets for the Island's under-utilized species such as sharks, tunas, and billfish.[385] Bermuda officials report that 1-2 mile experimental lines yielded sharks (tiger, blue, dusky, and makos) along with a few tunas (yellowfin, blackfin, bigeye, and albacore). This project and an associated one dealing with the development of nets for the flyingfish fishery were discontinued due to the lack of funds and the pressure of other work.

XVII. Enforcement

Bermuda on its own has virtually no at sea enforcement capability beyond approximately 50 km from the coast. Bermuda has no program to monitor, control, or surveil offshore fishing.[386] The DAF has no budget for at sea patrols and believes that the cost of providing such coverage would exceed the earnings of the entire fishing industry. The Bermuda Fisheries Act, however, makes every commissioned officer in the Royal Navy a "fisheries inspector" within the meaning of the Act. This grants the Royal Navy the theoretical power to assist in surveillance and enforcement in Bermudian waters.[387] One source reports that periodic patrols are conducted by the Royal Navy.[388]

The FD has three small boats for inshore patrol, but no highseas vessels.[389] The British Royal Navy vessel makes occasional calls and Bermuda enforcement may make use of such occasions to conduct surveillance in offshore waters. The Bermuda Marine police monitor fishing only in coastal waters. Officials are very strict about the pot ban if they can prove violations. Illegal fishing continues, but fishermen can lose their vessels. A major clamp down by authorities was reported in March 2000.[390] The MOE is assessing the feasibility of a Vessel Monitoring System (VMS) to provide electronic surveillance of offshore fishing vessels and to facilitate rescue services.[391] The fact that fish are not landed in one central location or small number of sites on the island greatly complicates even onshore fisheries enforcement. Any attempt to monitor the fisheries activity at the island's many small bays and coves would require a substantial staff and prove enormously expensive.[392]

XVIII. Future Trends

Bermuda has reported a substantial decline in its overall fisheries catch and the Government is encouraging fishermen to diversify. One possibility is the offshore pelagic longline fishery currently pursued by foreign fishermen. The Government has been supportive of efforts to launch a local longline fishery. The results to date, however, have been limited with only a small number of fishermen attempting to enter the fishery. Even the pot ban of 1990 did not motivate fishermen to enter the longline fishery.

Officials view chartering or other arrangements with foreign longline fishermen as a cost-effective way for Bermuda fishermen to enter the longline fishery. Various arrangements have been noted with Canadian and Cuban longliners since 1993. The Government has issued licenses to these longliners. No charter activity was reported in 2000.

Some Bermudian fishermen have attempted to initiate longline operations on their own. Only two fishermen were active in 2000 on a seasonal basis. Fishermen reported a catch of only 5 tons in 1997. One company in 2000 tried unsuccessfully to buy a longliner in the United States. There appear to be some difficulties Bermuda faces in launching a pelagic longline fishery. Local fishermen have no experience with the necessary longline fisheries technology. Investors are reluctant to commit the needed investment in longliners and gear and equipment for unknown returns. Nor does it seem that Bermudians, who have access to good paying jobs in the local tourist and financial services sectors, want to work on such fishing vessels. The extended trips is one factor to which many local workers object. As a result the island's offshore pelagic fishery resources have not yet been developed.

The Bermuda Government has promoted longlining, but does not appear to place a great emphasis on the expansion of fishery. The MOE in its 1990 Green Paper, *Marine Resources and the Fishing Industry in Bermuda*, reviewed the concerns of the DAF, commercial fishermen, and general public. The fishing community expressed great concern over conservation and protection of the marine environment, in part because of its importance to the tourist industry. In the MOE's discussion of future trends, a variety of concerns reflected this interest in the environment, including pollution, preservation of marine sites, the impact of shoreline development, anchor damage, marine parks, and others. Even in the "Fisheries-

Specific Issues," the MOE only briefly mentions the need for diversification of the fishing industry and does not specifically mention longlining.[393]

Given the available resource and the persistence of Bermudian fishermen and investors, it is likely that Bermuda's small longline operation will expand somewhat in the 2000s. Fishermen reported some progress with increased catches in 1998 and at least one fisherman is actively fishing and reporting increased success. There is no indication at this time, however, that there will be any great or rapid expansion of the small Bermuda longline fishery.

* * * *

Note: Bermuda officials have expressed concern that some of the journalistic articles and fishermen used in this report are "dubious" sources. The first step in preparing these reports is to contact the local fisheries office in order to obtain authoritative information. Unfortunately we have had to rely on these sources as Fisheries Department officials have not been able to obtain clearances from the Environmental Ministry and United Kingdom Foreign and Commonwealth Office to release data requested on licensing and other subjects. We have endeavored to work with the DAF. The DAF Director, John Barnes and his colleague Brian Luckhursrt have been most helpful within the limits imposed by the lack of needed clearances. The authors have also use journalistic and industry sources in the preparation of the Bermuda and other chapters. This is in part an effort to provide the views and opinions of the industry at large which may or may not be in accordance with official policies. The authors believe that an appreciation for the attitudes and opinions of local fishermen, whether they are valid or not, is important to understand the local fishery. This is not meant as a criticism of Bermudian or other officials. The same would be found in the United States and other countries. In many cases, fishermen around the world are critical of Government management regimes. The authors believe that it is important that U.S. fishermen, businessmen, academics, environmentalists, and others interested in Bermuda understand some of the varying opinions. This and other chapters are meticulously footnoted so the reader can assess the validity of the information provided. The authors have endeavored to also present the official Bermuda Government policies and positions, whenever officials were willing to provide that information. In particular, the authors suggest that interested readers consult the Ministry of the Environment's compendium *Marine Resources and the Fishing Industry in Bermuda* which was published in 2000. It is a wonderful authoritative source on Bermuda fisheries.

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35. Brian Luckhurst, Senior Fisheries Officer, Division of Fisheries, Department of Agriculture and Fisheries, Ministry of the Environment, personal communications, January 24, 2000.
36. Allen DeSilva, Mako Charters, personal communications, December 29, 1999.
37. MOE, *Marine Resources ..., op. cit.*, p. 144.
38. David DeSilva. Bermuda Recreational Fishing Association, Personal communication. March 7, 2000; Barns,*op. cit.*, March 17, 2000; Faries, *op. cit.*, April 1, 2000; and Craig Trott, *Trilogy* owner, personal communications, August 28, 2000.
39. Hainey, "Cuban trawler ...," *op. cit.* , p. 1.
40. The *Princess K* in 1993 was reportedly the first longliner to operate out of Bermuda. The authors are unsure, however, about the country of registry.
41. U.S. Consulate General, Hamilton, "U.S. marine mammal regulations," message number 358, August 12, 1980 and U.S. Department of State, "Tuna fleet compliance with U.S. marine mammal regulations," message number 107892, April 20, 1983.
42. U.S. Consulate General. Hamilton, "Questions concerning Bermuda tuna fleet's conformance with U.S. marine mammal regulations," message number 503, October 15, 1980.
43. ICCAT, "Report on statistics and coordination of research in 1993," COM-SCRS/93/12, *ICCAT Report* Part II, 1992-93 (ICCAT: Madrid, Spain, 1994), p. 26.
44. Barnes, *op. cit.*, September 26, 2000.
45. John A. Barnes, Director, Department of Agriculture, Fisheries, and Parks, personal communications, February 6, 1996 and DeSilva, *op. cit.*, December 29, 1999.
46. D. DeSliva, *op. cit.*, March 7, 2000.
47. Bermuda Deep Sea Fishing Charters, "Mako Charters," internet posting accessed December 27, 1999: http://bermudashorts.bm/mako/
48. Colin H. Benbow and James Burnett-Herkes,
"Island nation management of extended jurisdiction," *Proceedings of the Gulf and Caribbean Fisheries Institute*, Vol. 32, November, 1979 (GCFI: Miami, Florida, 1980), p. 61.
49. Mark Wildman, "Japan," *World Swordfish Fisheries* (NMFS, Silver Spring, Md., November, 1997), pp. 26-30.
50. Benbow and Burnett-Herkes, "Island nation management ...," *op. cit.*, p. 61.

SECTION V. (Shipyards)

51. Peter Watt, general manager, Offshore Yachting & Maintenance, personal communications, March 23, 2000.
52. Watt, *op. cit.*, March 23, 2000.
53. Craig Faries, *op. cit.*, March 17, 2000.
54. Paul Wring, General Manager, West End Yachts, personal communications, March 17, 2000.
55. Chris Cornell, Bermudians turn to New England for two fish-trap boats," *National Fisherman*, November, 1982, p. 68; *The Fish Boat*, December, 1985, p. 19; and Arch Davis, "Lobster boats ply foreign waters," *National Fisherman*, January, 1994, p. 36.
56. Wring, *op. cit.*, March 17, 2000.
57. Wring, *op. cit.*, March 17, 2000.

58. The fishermen in recent years have shifted from spice wood to galvanized steel to construct the traps. Moore, " Fishing in paradise ...," *op. cit.*, p. 7.
59. "Bermuda's fish stock waning fast," *The Daily Gleaner* (Kingston, Jamaica), October 10, 1988, p. 16.
60. Islands Resources Foundation, "Commission of Inquiry examines fishing industry in Bermuda," *Annual Report*, 1990.
61. Raymond Hainey, "Son of former Marine Board head arrested in fish pot raid," *The Royal Gazette*, March 2000. (Date not noted on clipping).
62. Barns, *op. cit.*, March 17, 2000.
63. Cabral, *op. cit.*, March 8, 2000.
64. Tim Greenfield, "More people arrested over illegal fishpots," *The Royal Gazette*, March, 2000. (Day not noted on the clipping.) Fishermen caught harvesting illegally can not continue fishing. Their vessels are impounded and hauled out of the water. Faries, *op. cit.*, April 1, 2000
65. David Kerstetter, VIMS, personal communications, August 29, 2000.
66. Trott, *op. cit.*, August 28, 2000
67. Federika Forth, Business Development Manager, Bank of Bermuda, personal communications, March 8, 2000.
68. Brian Luckhurst, Fisheries Officer, Division of Fisheries, personal communications, January 18, 2000.
69. Trott, *op. cit.*, August 28, 2000.
70. Neil Inchcup, Seamont Fisheries, personal communications, June 9, 2000.
71. Trott, *op. cit.*, August 28, 2000.
72. DAFP, "1997 national report ...," *op. cit.*
73. Barns, *op. cit.*, March 17, 2000.
74. Trott, *op. cit.*, August 28, 2000.
75. D. DeSilva, *op. cit.*, March 17, 2000.
76. Forth, *op. cit.*, March 8, 2000.
77. Inchcup, *op. cit.*, June 9, 2000 and Raymond Hainey, "Cuban trawler put in quarantine," *The Royal Gazette*, October 25, 1998. While the article refers to a trawler, the Cuban vessel *Jurel* was actually a longliner.
78. Nelson, *op. cit.*, August 21, 2000.
79. Luckhurst, *op. cit.*, January 18, 2000.
80. Barns, *op.cit.*, March 17, 2000.
81. Tony Cordeiro, "What a whopper!, *The Royal Gazette*, January 7, 2000.
82. Nelson, *op. cit.*, August 21, 2000.
83. Barns, *op. cit.*, March 17, 2000 and Trott, *op. cit.*, August 28, 2000.
84. Inchcup, *op. cit.*, June 9, 2000.
85. Inchcup, *op. cit.*, June 9, 2000.
86. A British graduate student in 1999 compiled the first detailed study of the island's recreational fishery, compiling an enormous amount of information. Maryellen Goodwin, "Study on fishing and economy," *The Royal Gazette*. May 19, 1999.
87. A. DeSilva, *op. cit.*, December 29, 1999.
88. D. DeSilva, *op. cit.*, March 7, 2000.
89. A. DeSilva, *op. cit.*, December 29, 1999.
90. Captain Allen, Fish Bermuda, "Weekly fishing report," internet posting accessed December 27, 1999: http://www.fishbermuda.com/fishing.html
91. S.L. "Pete" Perinchief, *Bermuda: Island of Great Fishing* (Bermuda Fishing Information Bureau: Hamilton, date unknown), 24p.
92. A. DeSilva, *op. cit.*, December 29, 1999.
93. MOE, *Marine Resources ..., op. cit.*, p. 171.
94. Brian E. Luckhurst, "Demography of Bermuda's marlin fishery - catches of blue marlin (*Makaira nigricans*) and white marlin (*Tetrapterus albidus*) during the period 1975-1995 with comments on tagging and tournament fishing effort," *ICCAT Collective Volume of Scientific Papers* Vol. XLVII (SCRS/96/91) (Madrid: ICCAT, 1998), pp. 131-134.
95. "The traveling fisherman," *Saltwater Sportsman*, July 1994, p. 80 and A. DeSilva, *op. cit.*, December 29, 1999.
96. The weekly report is available at: http://www.fishbermuda.com/fishing.html, retrieved April 22, 1999.
97. Luckhurst, "Landings of blue marlin ...," *op. cit.*, p. 220.

98. Captain Allen, "Mako charters," http://bermudashorts.bm/mako/, retrieved April 22, 1999.
99. A. DeSilva, *op. cit.*, December 29, 1999.
100. Brian E. Luckhurst, "Billfish research and implications for management in Gulf and Caribbean waters," *Proceedings of the Gulf and Caribbean Fisheries Institute, 1998*, vol. 51.
101. Barnes, *op.cit.*, February 6, 1996.
102. Bermuda Hotel Association, "About Bermuda - Sports," internet posting, accessed June 8, 2000: http://www.bermudahotels .com/bermuda/aboutspo.htm
103. D. DeSilva, *op. cit.*, March 7, 2000.
104. Hellin, "An assessment ...," *op. cit.*, pp. 22-23.
105. Barns, *op. cit.*, March 17, 2000.
106. D. DeSilva, *op. cit.*, March 7, 2000.
107. Keith Forbes, "Bermuda's deepsea sport fishing," http://bermuda-online.org/fishing.htm, retrieved April 22, 1999.
108. ICCAT, "Report of the meeting of the standing committee on research and statistics," *ICCAT Report* Part II, 1992-93 (ICCAT: Madrid, Spain, 1994), p. 212.
109. A. DeSilva, *op. cit.*, December 29, 1999.
110. Luckhurst, "Billfish research," *op. cit.*
111. MOE, *Marine Resources ..., op. cit.*, p. 169.
112. MOE, *Marine Resources ..., op. cit.*, pp. 168-170.
113. A. DeSilva, *op. cit.*, December 29, 1999.
114. Luckhurst, "Billfish research," *op. cit.*
115. D. DeSilva, *op. cit.*, March 7, 2000.
116. D. DeSilva, *op. cit.*, March 7, 2000.
117. Barnes, *op. cit.*, February 6, 1996.
118. U.S. Consulate General, Hamilton, "Japanese tuna fishing off Bermuda," message number 575, October 30, 1979.
119. Mr. Hasitani, Assistant General Manager, Nichirei Carib Corporation, as cited in MRAG, "Large pelagic fisheries in the Caribbean: Their role in the economies of U.K. dependent territories," report to the Overseas Development Administration, final report, June 1993, p. 56.
120. Luckhurst, *op. cit.*, January 18, 2000.
121. Jean Cramer, "Large pelagic logbook newsletter, 1995," *NOAA Technical Memorandum* NMFS-SEFSC-394 (NMFS: Miami, Florida, November, 1996), p. 3.
122. Temporarily transferring the flag allows the vessel to operate as a local vessel with access to the EFZ.
123. Anonymous source, personal communications, March 10, 2000. NMFS can not deny or confirm these rumors, but presents them as information about what the local small-scale fishermen are saying.
124. NMFS would prefer to report more definitive statements by the Fisheries Division and other appropriate Government officials. Senior Fisheries Officer Brian Luckhurst informed the authors on January 24, 2000 that the release of such information needs to be approved by his Director. Mr. Luckhurst, however never received such approval.
125. Inchcup, *op. cit.*, June 9, 2000 and Nelson, *op. cit.*, August 21, 2000.
126. Discrepancies between exporters and U.S. import data are not uncommon. In some cases shipments of fish are misidentified in the official data. It is also possible that shipments may have been identified as of Canadian origin.
127. Inchcup, *op. cit.*, June 9, 2000.
128. The Cuban Ministry of the Fisheries Industry was at the time closing FAC and renting the few remaining longliners. Apperantly they decided to try to lease the *Jurel* before selling or scraping it. For details on FAC, see the Cuban Chapter of this report.
129. High maintenance costs were one reason the FAC did not operate profitably and that the remaining vessels were being retired.
130. Brian Rowlinson, Acting Permanent Secretary of the Environment as cited by Raymond Hainey, "Cuban trawler put in quarantine," *The Royal Gazette*, October 28, 1998, p. 1.
131. Tim Greenfield, "Inchcup blasts 'Humiliating' treatment of Cuban fishermen," *The Royal Gazette*, November 5, 1998, p. 2.
132. Inchcup, *op. cit.*, June 9, 2000.
133. Inchcup, *op. cit.*, June 9, 2000 and Joya Nelson, Seamont Fisheries, personal communications, August 21, 2000.

134. A. DeSilva, *op. cit.*, December 29, 1999.
135. Inchcup, *op. cit,* June 9 and August 21, 2000. Inchcup is now attempting to purchase a used longliner. longliner.
136. Inchcup, *op. cit.*, June 9, 2000.
137. Landings were also reported December 4, 1998 and January 6, 1999. Tony Cordeiro, "What a whopper!," *The Royal Gazette*, January 7, 1999, p. 1; Inchcup, *op. cit.*, June 9, 2000; and Nelson, *op. cit.*, August 21, 2000.
138. Hainey, "Cuban trawler ...," *op. cit.*, p. 1 and Cordeiro, "What a whopper!," *op. cit.*, p. 1.
139. In Cuba, seafood demand exceeds the supply to such an extent that virtually any landed product can be sold. For details see the Cuban chapter of this report.
140. In most countries the fins are part of the crew's earnings. The authors are not sure of the policies on a Cuban longliner.
141. Nelson, *op. cit.*, August 23, 2000.
142. Hainey, "Cuban trawler ...," *op. cit.*, p. 1.
143. Nelson, *op. cit.*, August 21, 2000.
144. The difficulties contacting the FAC were probably related to the Cuban Government's decision to cease operations in 1996. Apparently a skeleton staff was retained to close down operations and sell the fleet. The *Jurel* was apparently a vessel that had not yet been sold. For details see the Cuban chapter of this report.
145. Nelson, *op. cit.*, August 23, 2000.
146. Luckhurst, "Landings of blue marlin ...," *op. cit.*, p. 218.
147. Luckhurst, "Landings of blue marlin ...," *op. cit.*, p. 218.
148. Luckhurst, "Landings of blue marlin ...," *op. cit.*, p. 218.
149. DAF, *Report for the Year, 1987*, p. 23.
150. DAF, *Report for the Year, 1988*, p. 20.
151. Inchcup, *op. cit.*, June 9, 2000.
152. DAFP, "1997 national report ...." *op. cit.*
153. Hainey, "Cuban trawler ...," *op. cit.*, p. 1.
154. Nelson, *op. cit.*, August 21, 2000.
155. Cordeiro, "What a whopper!," *op. cit.*, January 7, 1999, p. 1.
156. Nelson, *op. cit.*, August 23, 2000.
157. Inchcup, *op. cit.*, June 9, 2000.
158. Barnes, *op. cit.*, September 26, 2000.
159. Barnes, *op. cit.*, September 26, 2000.
160. Barnes, *op. cit.*, September 26, 2000.
161. Barnes, *op.cit.*, February 6, 1996.
162. For details on foreign operations see the "International" section of this report.
163. MOE, *Marine Resources ..., op. cit.*, p.98.
164. MOE, *Marine Resources ..., op. cit.*, p.98.

SECTION VIII. (Ports)

165. Hellin, "An assessment ...," *op. cit.*, p. 16.
166. Cabral, *op. cit.*, March 8, 2000.
167. Hellin, "An assessment ...," *op. cit.*, p. 8.

SECTION IX. (Transshipments)

168. John A. Barnes, Director, Department of Agriculture, Fisheries and Parks, personal communications, March 18, 1996.
169. Barnes, *op.cit.*, February 6, 1996.
170. Danny Farias, personal communications, March 15, 1977.
171. U.S. Consulate General, Hamilton, "Japanese transhipment of fish via Bermuda," message number 800, September 14, 1987.
172. U.S. Consulate General, Hamilton, "Japanese transhipment...," *op. cit.*, September 14, 1987.

SECTION X. (Processing and products)

173. Hellin, "An assessment ...," p. 8.
174. Joya Nelson, Marketing Manager, Seamont Fisheries, personal communications, August 21, 2000 and Trott, *op. cit.*, August 28, 2000.
175. Trott, *op. cit.*, August 28, 2000.
176. Trott, *op. cit.*, August 29, 2000.

SECTION XI. (Companies)

177. Barns, *op. cit.*, March 17, 2000.
178. Barnes, *op. cit.*, September 26, 2000.
179. Nelson, *op. cit.*, August 21, 2000.
180. See details in the international section.
181. Nelson, *op. cit.*, August 21, 2000.
182. Nelson, *op. cit.*, August 21, 2000.
183. Greenfield, "Inchcup blasts ...," *op. cit.*, November 5, 1998.
184. Nelson, *op. cit.*, August 21, 2000.
185. Cordeiro, "What a whopper!," *op. cit.*, p. 1.
186. Nelson, *op. cit.*, August 21, 2000.
187. Inchcup, *op. cit.*, June 9, 2000.
188. Nelson, *op. cit.*, August 21, 2000.
189. The authors attempted to discuss the leasing experience off Bermuda along with other topics with the FAC, but company officials did not respond.
190. Inchcup, *op. cit.*, June 9, 2000.
191. Nelson, *op. cit.*, August 21, 2000.
192. Luckhurst, *op. cit.*, January 18, 2000.
193. Trott, *op. cit.*, August 28, 2000
194. MOE, *Marine Resources ..., op. cit.*, p. 145.

SECTION XII. (Markets)

195. Cabral, *op. cit.*, March 8, 2000.
196. Moore, "Fishing in paradise ...," *op. cit.*, December 4, 1987, p. 7.
197. Wring, *op. cit.*, March 17, 2000.
198. D. DeSilva, *op. cit.*, March 7, 2000.
199. Hellin, "An assessment ...," *op. cit.*, p. 8.
200. MOE, *Marine Resources ..., op. cit.*, p. 191.
201. MOE, *Marine Resources ..., op. cit.*, pp. 191-192.
202. Cabral, *op. cit.*, March 8, 2000.
203. Barnes, *op. cit.*, September 22 and 26, 2000.
204. Bermuda officials indicate that reports published in various journals alleging that 100 t or more of swordfish was exported or transhipped to the United States are totally erroneous. Barnes, *op. cit.*, September 22, 2000.
205. They believe that perhaps similarly named Caribbean islands like Barbuda or Barbados may have led to this confusion. Barnes, *op. cit,* September 22, 2000.
206. Trott, *op. cit.,* August 28, 2000.
207. MOE, *Marine Resources ..., op. cit.*, p. 192.
208. Barnes, *op, cit.*, September 26, 2000.

SECTION XIII. (Government Policy)

153. Proclamation No. 202, May 20, 1977.
210. MOE, *Marine Resources ..., op. cit.*, p. 36.
211. Order in Council, November 28, 1988.
212. Ian Kawaley, "The implications of the Exclusive Economic Zone and EEZ management for Bermuda, a small mid-ocean island Commonwealth territory," *Ocean Development and International Law*, Vol. 26, July-December, 1995, p. 238.

213. Details on Bermuda's fisheries management program are available in Dennis Weidner, "Bermuda proposes fisheries management plan," *International Fisheries Report* (IFR-83/31).
214. Islands Resources Foundation, "Commission of Inquiry ...," *op. cit.*
215. DAF, *Fish Pot Ban*, 1990
216. Kawalet, "The implications ...," *op. cit.*, p. 244.
217. MOE, *Marine Resoirces ..., op. cit.*, pp. 2-5.
218. U.S. Consulate General, Hamilton, "Japanese tuna fishing...," *op cit.*, October 30, 1979.
219. U.S. Consulate General, Hamilton, personal communications, December 9, 1981.
220. Barnes, *op. cit.*, personal communications, March 18, 1996.
221. MOE, *Marine Resources ..., op. cit.*, p. 189.
222. Luckhurst, *op. cit.*, January 18, 2000.
223. Barnes, *op.cit.*, February 6, 1996.
224. Barnes, *op. cit.*, March 18, 1996.
225. Barnes, *op.cit.*, February , 1996.
226. At the time the licensing fee was $1,000 plus $1 per vessel GRT. FAO, "Bermuda: Implications ...," op. cit., p. 192.
227. MOE, *Marine Resources ...*, op. cit., p. 183.
228. Luckhurst, *op. cit.*, January 18, 2000.
229. For more details on the Taiwan fishing operations out of St. Maarten, see the Netherlands Antilles chapter of this report.
230. Benbow and Burnett-Herkes, "Island nation management ...," op. cit., p. 61.
231. Charles W. Moore, "Bermuda wants the Canadians back," Atlantic Fisherman, August, 1994, p. 13.
232. Luckhurst, *op. cit.*, January 18, 2000.
233. Luckhurst, *op. cit.*, January 24, 2000. Mr. Luckhurst never was able to get the needed clearance.
234. Inchcup, *op. cit.*, June 9, 2000.
235. Luckhurst, *op. cit,*, January 18, 2000.
236. Bermuda Stautory Instrument, SR&O 25/1972, Fisheries Regulations, 1972, 1989 Revision, update #7 as of August 1998, Regulation 13.
237. D. DeSilva, *op. cit.*, March 7, 2000.
238. An exception is made for retail outlets like supermarkets and restaurants. Bermuda Stautory Instrument, SR&O 25/1972, Fisheries Regulations, 1972, 1989 Revision, update #7 as of August 1998, Regulation 13.
239. MOE, *Marie Resources ..., op. cit.*, p. 184.
240. Barns, *op. cit.*, March 17, 2000.
241. Barns, *op. cit.*, March 17, 2000.
242. Hellin, "An assessment ...," *op. cit.*, p. 8.
243. MOE, *Marine Resources ..., op. cit.*, pp. 180-181.
244. MOE, *Marine Resources ..., op. cit.*, p. 186.
245. D. DeSilva, *op. cit.*, March 7, 2000.
246. Barnes, *op. cit.*, September 26, 2000. Some thoughts concerning options associated with a recreational fishing license for Bermuda are presented in MOE, *Marine Resources, op. cit.*, pp. 186-189.
247. Barnes, *op. cit.*, September 26, 2000.
248. FAO, "Bermuda:..," op cit., (FAO: Rome, 1981), pp. 190-193. The project attempted to develop products from these species that would be acceptable to Bermudian consumers including products produced from tuna (smoked and boiled for salads) and marlin (smoked hams and boiled for salmon-style products). WECAF, "Fisheries situation in Bermuda," *Seminar for Project Liaison Officers of the English speaking Countries*, Panama City, Panama, September 12-14, 1979.
249. DAF, Report for the Year, 1988, p. 20.
250. U.S. Consulate General, Hamilton, "Bermuda roundup: Summary of local events," message number 762, January 11, 2000.
251. U.S. Consulate General, Hamilton, "Bermuda roundup: Summary of local events," message number 95, February 14, 2000.
252. U.S. Consulate General, Hamilton, "Bermuda roundup: Summary of local events," message number 116, February 18, 2000.
253. Federika Forth, Business Development Manager, Bank of Bermuda, personal communications, March 8, 2000.
254. Barnes, *op. cit.*, September 26, 2000.
255. Carmen Burgess, Relations Manager, N.T. Butterfield Bank, personal communications, March 8, 2000.

256. Burgess, *op. cit.*, March 8, 2000.
257. MOE, *Marine Resources ..., op. cit.*, p. 13.
258. MOE, *Marine Resources ..., op. cit.*, p. 145.
259. MOE, *Marine Resources ..., op. cit.*, p. 13.
260. See the Bahamas chapter of this report for details.
261. MOE, *Marine Resources ..., op. cit.*, p. 144.
262. John Barnes, "Report of attendance at the meeting of the ICCAT Working Group on Allocation Criteria," Madris Spain, May 31-June 2, 1999.
263. E.L. Towle, R.S. Carney, and R.C. Mahon, *Report to the Commission of Inquirt tonexamone and make recommendations for the future if the fishing industry and for the future protection of the marine environment in Bermuda* (Government Information Services, 1991).
264. MOE, *Marine Resources ..., op. cit.*, pp. 145-146.
265. Meylan, *op. cit.*, September 21, 2000.

SECTION XIV. (Research)

266. Some of the few such studies include: Louis S. Mowbray, "Exploring fishing in Bermuda waters," paper presented at the Gulf and Caribbean Fisheries Institute, November 17-21, 1952; Louis S. Mowbray, "The modified tuna long-line in Bermuda waters," paper presented at the Gulf and Caribbean Fisheries Institute, October 31-November 4, 1955; and Feasibility Study of an Offshore Fishing Industry for Bermuda (Bermuda College: Devonshire, Bermuda, 1974).
267. The Fish Boat, December, 1980, p. 59.
268. E.D. Prince, "Progress of the ICCAT Enhanced Research Program for Billfish in the Western Atlantic Ocean during 1994," ICCAT Collective Volume of Scientific Papers (SCRS/94/147), Vol. 44, no. 3, 1985, pp. 6-8.
269. E.D. Prince, "Progress of the ICCAT Enhanced Research Program for Billfish in the Western Atlantic during 1995," ICCAT Collective Volume of Scientific Papers (SCRS 95/107), 1995, Vol. 45, no. 2, pp. 308-310.
270. DAFP, "1997 national report ...," *op. cit.*
271. Brian E. Luckhurst, "Analysis of Bermuda's marlin fishery--Catches of blue marlin (*Makaira nigricans*) and white marlin (*Tetrapterus albidus*) during the period 1975-1995 with comments on tagging and tournament fishing effort," *ICCAT Collective Volume of Scientific Papers*, Vol. 47 (ICCAT: Madrid, 1998), p. 132.
272. Dan Hellin, Junior Research Associate, Newcastle University, personal communications, March 9, 2000.
273. Luckhurst, *op. cit.*, March 8, 2000.
274. Smith-Vaniz, Collette, and Luckhurst, *Fishes of Bermuda*, *op. cit.*, p. 335.
275. FAO, "Bermuda--Implications for Bermuda of a Two..." *op. cit.*, 1981.
276. The British company had extensive overseas operations and experienced some success at some of these operations in supplying sashimi-grade fish to Japan and was considering expanding its fishery operations. Barners, *op. cit.*, September 26, 2000.
277. MOE, *Marine resources ..., op. cit.*, pp. 143-144.
278. Hellin, "An assessment ...," op. cit.
279. Jerole Ault, University of Miami, personal communication, March 30, 2000.
280. David Kerstetter, Virginia Institute of Marine Science, personal communications, April 10, 2000.
281. This research was initiated by Dr. H. Clay Frick of the CCC and Dr. James Burnett-Herkes of the DAF. Department of Agriculture and Fisheries (DAF), Report for the Year, 1979, p. 17 and Anne Meylan, Research Scientist, Florida Marine Research Institute, personal communications, September 21, 2000.

SECTION XV. (Bycatch)

282. Mr. Hasitani, Assistant General Manager, Nichirei Carib Corporation, as cited in MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 56.
283. Mr. Hasitani, Assistant General Manager, Nichirei Carib Corporation, as cited in MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 56.
284. Cabral, *op. cit.*, March 8, 2000.
285. Luckhurst, "Landings of blue marlin ...," *op. cit.*, p. 219.
286. Luckhurst, "Landings of blue marlin ...," *op. cit.*, p. 219.
287. Cabral, *op. cit.*, March 8, 2000.
288. Luckhurst, "Billfish research," *op. cit.*

289. Luckhurst, "Billfish research," *op. cit.*
290. Luckhurst, "Analysis of Bermuda's ...," *op. cit.*, p. 134.
291. ICCAT Secretariat, "Summary of shark by-catch statistics received," *ICCAT Collective Volume of Scientific Papers* (SCRS/96/7), Vo. 46, No. 4 (ICCAT: Madrid, 1997), p. 374.
292. Nelson, *op. cit.*, August 21, 2000.
293. Nelson, *op. cit.*, August 21, 2000.
294. David W. Kerstetter, Marine Advisory Services, personal communications, September 8, 2000.
295. Luckhurst and Trott, "Bermuda's commercial line fishery ...," *op. cit.*
296. One would assume that the Spanish colonies in Central and South America may have earlier enacted some similar legislation, but the authors are unaware of any.
297. DAF, Report for the Year, 1979, *op. cit,*, p. 17.
298. Barns, *op. cit.*, March 17, 2000.
299. Meylan, *op. cit.*, September 21, 2000.
300. MOE, *Marine Resources ..., op. cit.*, p. 222.
301. U.S. Consulate General, Hamilton, "Conservation of sea turtles," message number 456, August 23, 1979.
302. Meylan, *op. cit.*, September 21, 2000.
303. Meylan, *op. cit.*, September 21, 2000
304. MOE, *Marine Resources ..., op. cit.*, p. 223.
305. Meylan, *op. cit.*, September 21, 2000
306. Lamarr Trott, NMFS, personal communications, August 3, 2000.
307. MOE, *Marine Resources ..., op. cit.*, p. 222.
308. See the Cuban chapter of this report for details.
309. Caribbean Conservation Corporation, "Bermuda sea turtle species," internet posting accessed June 12, 2000: http://www.cccturtle.org/bermuda/bermudaspecies.htm and MOE, *Marine Resources ..., op. cit.*, p. 224.
310. Meylan, *op. cit.*, September 21, 2000.
311. Caribbean Conservation Corporation, "Bermuda sea turtle species," internet posting accessed June 12, 2000: http://www.cccturtle.org/bermuda/bermudaspecies.htm and Meylan, *op. cit.*, September 21, 2000.
312. See "Research" for details.
313. Caribbean Conservation Corporation, "An in-water experience," internet posting accessed June 12, 2000: http://www.cccturtle.org/bermuda/inwater.htm
314. Meylan, *op. cit.*, September 21, 2000.
315. A. DeSilva, *op. cit.*, December 29, 1999.
316. Barns, *op. cit.*, March 17, 2000.
317. Kerstetter, *op. cit.*, September 8, 2000.
318. Meylan, *op. cit.*, September 21, 2000.
319. Karen Smith, "Tied-up turtle rescued by fishermen," *Royal Gazette*, March 23, 2000.
320. As the primary focus of this report is the Caribbean, the authors will not go into detail about longline interactions off the United States. A detailed discussion is available in Darlene R. Johnson, Cynthia Yeung, and Craig A. Brown, "Estimates of marine mammal and marine turtle bycatch by the Atlantic pelagic longline fleet in 1992-1997," *NOAA Technical Memorandum*, NMFS-SEFSC-419, April 1999, 70p.
321. Smith, "Tied-up turtle ...," *op. cit.*
322. MOE, *Marine Resources ..., op. cit.*, pp. 149 and 225.
323. A. DeSilva, *op. cit.*, December 29, 1999.
324. Kerstetter, *op. cit.*, September 8, 2000.
325. Kerstetter, *op. cit.*, September 8, 2000.
326. M.E. Baltz, M.J. Burke, and P.J. Davidson, "New records of Audubon's shearwater (*Puffinus lherminieri*) breeding colonies in the Exuma Cays," *Bahamas Journal of Science*, Vo;. 6, no. 1, November 1998, pp. 43-46.
327. Van Halewyn and Norton, 1984 in M.E. Baltz, M.J. Burke, and P.J. Davidson, "New records of Audubon's shearwater (*Puffinus lherminieri*) breeding colonies in the Exuma Cays," *Bahamas Journal of Science*, Vo;. 6, no. 1, November 1998, pp. 43-46.
328. David Wingate, personal communications, in Van Halewyn and Norton, 1984 in Baltz, Burke, and Davidson, "New records of Audybon's shearwater ...," *op. cit.*
329. Moore, "Bermuda wants ...," *op. cit.*, p. 13 and "Bermuda may join conservation group," *Royal Gazette*, September 6, 1994, p. 3.

330. The special treatment of the U.K. Overseas Territories arises from the fact that they were not included in the Treaty of Rome when the United Kingdom joined the European Economic Community, now known as the European Union.

SECTION XVI. (International)

331. ICCAT, "Report of the meeting of the Infractions Committee," ICCAT Report, Part I, 1990-91, (ICCAT: Madrid, Spain, 1991), p. 94.
332. Moore, "Bermuda wants ...," *op. cit.*, p. 13.
333. MOE, *Regional Management ..., op. cit.*, p. 12.
334. Barnes, "Report on attendance ...," *op. cit.*
335. For details on the status of these longline fisheries, see the individual island reports. There are several other Overseas Territories (Cayman Islands, Montserrat, and the Turks and Caicos, but they do not at present have pelagic longline fisheries).
336. U.S. Consulate General, Hamilton, "Bermuda roundup: Summary of local events," *op cit.* January 11, 2000.
337. Barnes, "Report on attendance ...," *op. cit.*
338. Barnes, *op. cit.*, September 26, 2000.
339. MOE, *Marine Resources ..., op. cit.*, p. 41.
340. Barnes, "Report on attendance ...," *op. cit.*
341. MOE, *Marine Resources ..., op. cit.*, pp. 39-40.
342. Cabral, *op. cit.*, March 8, 2000.

SECTION VII. (Catch)

343. At the author's request, Chief Fisheries Officer Brian Luckhurst has requested permission from the Minister of Agriculture to release data on the foreign licensing program, but at the time this report was finalized, the minister has not given his permission to release it. U.S. Consulate General, Hamilton, "Request for fisheries information," message number 291, March 27, 2000. DAF Director John Barnes confirmed that permission was also needed from the Foreign and Commonwealth Office. Barnes, *op. cit.*, September 22, 2000.
344. Readers should understand that information that is routinely available to the public in the United States and European countries is often retained by Governments in the Caribbean area, including Bermuda, as privileged information. This is done because many of the Government do not operate with the same level of transparency as Governments in the United States and Europe. Officials are often concerned about how information will be used and simply take the "safest" option and not release it. This is sometimes the case even on islands like Bermuda where there is a well established democratic Government. The public in these countries is often more tolerant to this approach than is the case in the United States and Europe. The former Chief Fisheries Officer, John Barnes, now the DAF Director, did release some data on the large scale licensing program in the late 1970s and early 80s (appendix D2a-b). Bermuda and British officials, however, declined to release even historic data. The authors are unsure as to why officials consider this data sensitive.
345. Barnes, *op. cit.*, March 18, 1996.
346. Barnes, *op. cit.*, September 22, 2000.
347. Barnes, *op. cit.*, September 22, 2000.
348. MOE, *Marine Resources ..., op. cit.*, p. 144.
349. Moore, "Bermuda wants ...," *op. cit.*, p. 13.
350. D. DeSilva, *op.cit.*, March 7, 2000.
351. Moore, "Bermuda wants ...," *op. cit.*, p. 13.
352. "Disgruntled skipper aided boat seizure," Royal Gazette, May 19, 1994, p. 1 and "Canada passes law to confront foreign fishermen," *Royal Gazette*, June 9, 1994, p. 2.
353. The Bermudians report that a DFO fish inspector appeared at St. George's without first contacting the proper Bermudian officials. Moore, "Bermuda wants ...," *op. cit.*, p. 13.
354. NR-HQ-94-35E.
355. Dale Crory, U.S. Consulate General, Halifax, personal communications, December 20, 1995.
356. Inchcup, *op. cit.*, June 9, 2000.
357. Hainey, "Cuban trawler ...," *op. cit.*, p.1.
358. Cordeiro, "What a whopper!" *op. cit.*, p. 1.
359. Inchcup, *op. cit.*, June 9, 2000.

360. Inchcup, *op. cit.*, June 9, 2000.
361. "Development of the fishing industry in Bermuda," Dansk Fiskeritidene, November 29, 1979 and Benbow and Burnett-Herkes, "Island nation management ...," *op. cit.*, p. 61.
362. See for example SCRS Swordfish Assessment Group, "Reference paper on 1991 swordfish stock assessment," Collective Volume of Scientific Papers, (SCRS/91/116) Vol. XXXIX (2) (ICCAT: Madrid, May 1992), p. 471 figure 4.
363. U.S. Consulate General, Hamilton, "Japanese tuna fishing off Bermuda," message number 575, October 30, 1979.
364. Benbow and Burnett-Herkes, "Island nation management ...," *op. cit.*, p. 61.
365. Farias, *op. cit.*, March 15, 1977.
366. U.S. Consulate General, Hamilton, "Japanese tuna fishing off Bermuda," message number 575, October 30, 1979.
367. J. Mejuto, P. Sánchez, and J.M. de la Serna, "Nominal-catch per unit of effort by length groups and areas of the longline Spanish fleet targeting swordfish (Xiphias gladius) in the Atlantic, years 1988 to 1990 combined," *Collective Volume of Scientific Papers*, (SCRS/91/49) Vol. XXXIX (2) (ICCAT: Madrid, May 1992), pp. 615-625.
368. U.S. Consulate General, Hamilton, "Japanese transhipment...," *op. cit.*, September 14, 1987.
369. For details see the St. Maartens chapter of this report.
370. For details see the Trinidadian chapter of this report.
371. DAF, Report for the Year, 1987, *op. cit.*, p. 25.
372. Luckhurst, *op. cit.*, January 18, 2000.
373. Luckhurst, *op. cit.*, January 18, 2000.
374. Moore, "Bermuda wants ...," *op. cit.*, p. 13.
375. Details on the U.S. swordfish fishery are available in Karyl K. Brewster-Geisz, "United States," World Swordfish Fisheries, Vol. V. (NMFS: Silver Spring, Maryland), pp. 63-102.
376. Barnes, *op. cit.*, September 22, 2000.
377. MOE, *Marine Resources, op. cit.*, p. 143.
378. Jean Cramer and Heather Adams, "Large pelagic logbook newsletter - 1996," NOAA Technical Memorandum (NMFS-SEFSC-407), January 1998, p. 3 and Jean Cramer, "Large pelagic logbook newsletter - 1995," *NOAA Technical Memorandum* NMFS-SEFSC-394, November, 1996, p. 3.
379. Cramer. "Large pelagic logbook newsletter," *op. cit.*
380. U.S. Consulate General, Hamilton, "Inquiry about establishing a Soviet fishing base in Bermuda," message number A-112, June 9, 1966 and Farias, *op. cit.*, March 15, 1977.
381. FAO, "Bermuda: Implications ...," *op. cit.*, p. 193.
382. Inchcup, op. cit., June 9, 2000.
383. "Fishing cooperation with Bermuda," Haptong, Seoul radio broadcast, 0309 GMT, September 19, 1974; U.S. Department of State, "Establishment of a fishing base in Bermuda for Korean fleet," message number 228280, October 17, 1974; and U.S. Consulate General, Hamilton, "Proposed Korean-Bermudian joint fishing venture," message number 262, October 29, 1974.
384. MOE, *Marine Resources ...*, op. cit., p. 143.
385. FAO, "Bermuda--Implications for Bermuda of a Two..." *op. cit.*, 1981.
386. U.S. Embassy, Hamilton, "Monitoring, control, and surveillance of fisheries," message number 175, March 4, 1994.
387. FAO, "Bermuda: Implications ...," op. cit., p. 193.
388. Moore, " Fishing in paradise ...," op. cit., p. 7.
389. MOE, *Marine Resources ..., op. cit.*, p. 20.
390. Hainey, "Son of former Marine Board head arrested ...," op. cit., March 2000.
391. MOE, *Marine Resources ..., op. cit.*, p. 293.

SECTION XVII. (Enforcement)

392. Hellin, op. cit., p. 8.
393. MOE, *Marine Resources ..., op. cit.*, pp. 291-294.

Appendices

Series A: Fleet
Series B: Catch Data
Series C: Transshipments
Series D: Foreign Fishing and Licenses
Series E: Market
Series F: Exports
Series G: Sports Tournaments

Appendix A1.--Bermuda. Fishing vessel licenses, 1997-98

Annual activity level	Year 1997	1998
	Number	
Full time*	77	62
<30 hours	50	48
<10 hours	47	40
No activity	44	36
Total**	194	189

* 100 days at sea per year.
** As reported in source, the authors are unsure why the totals do not add.
Source: Ministry of the Environment, *Marine Resources and the Fishing Industry in Bermuda*. Referred to as the Green Paper (MOE, January 2000), p. 180.

Appendix A2a.--Bermuda. Fishing vessels, 1982-1997

Year	Longliner 0-50	51-200	201-500	501	Rod/ reel	Unknown	Total
	Number of vessels						
1982	-	-	-	-	NA	-	NA
1983	-	-	-	-	NA	-	NA
1984	-	-	-	-	NA	-	NA
1985	-	-	-	-	NA	-	NA
1986	-	-	-	-	NA	-	NA
1987	-	-	-	-	NA	-	NA
1988	-	-	-	-	NA	-	NA
1989	-	-	-	-	198	-	198
1990	-	-	-	-	198	-	198
1991	-	-	-	-	197	-	197
1992	-	-	-	-	195	-	195
1993	-	-	-	-	195	-	195
1994	-	-	-	-	195	-	195
1995	-	-	-	-	192	-	192
1996	2	-	-	-	192	-	194
1997	2	-	-	-	192	-	194

NA - Not available
Source: ICCAT. *Statistical Bulletin*, various years.

Appendix A2b.--Bermuda. Tuna/swordfish longliners, 1998-2000

Name	Owner	Size	Hull	Berth	Notes
		Meters			
Domestic					
Commercial					
Ark Angel	Robert Lambe	21	Steel	NA	Active since 1996
Cutlass	Craig Trott	8	GRP	St. George's	Active 1994-96
Princess K	Robert Lambe	NA	GRP	NA	Active in the mid-1990s
Trilogy	Craig Trott	16	GRP	St. George's	Active since 1996 2000
Unknown	Neil Inchcup	NA	NA	NA	Attempt to purchase in process
Research					
Calamus	Fisheries Div.				Experimental longlining, now used for turtle research by the ???
Canadian					
Alexis I	Neil Inchcup	NA	NA	NA	Brought in 1996, inactive in 1998
Cuban					
Jurel	FAC*	60E	Steel	St. George's	Active in 1998-99, contract not renewed in 2000

NA - Not available
* Cuban Flota Atunera de Pesca, leased by Neil Inchcup
Sources: Various

Appendix A3.--Bermuda. Foreign-owned purse seiners registered in Bermuda

Vessel	Size*	Dates Registered	Dates Removed
	GRT		
Angela	573	NA	5/18/79
Jasna	573	NA	5/10/79
Kamala	389	[1980**]	
Kpeshie	335	[1975-80**]	
Pawn Pawn	335	[1975-80**]	
Torro Bravo	1,557	[1981***]	
Vida	573	NA	6/15/79

* Many of these vessel sizes appear small for purse seiners, it is unclear as to why such small seiners are being registered in Bermuda and in what fisheries they were deployed
** Registrations dates are unavailable, but the indicated vessels were on the registration role during the years indicated.
*** The *Torro Bravo* was the only foreign tuna purse seiner remaining on Bermudian registry by late 1982.
# These vessels were note on the Bermudian registry as early as 1975.
Sources: "Les flottilles thonières non-américaines dans le Pacifique centre-est," *Pêche Maritime*, July 20, 1975, p. 498; Walwyn Hughes, Bermuda Department of Agriculture and Fisheries as reported in U.S. Consulate General, Hamilton, "U.S. marine mammal regulations," message number 358, August 12, 1980; U.S. Consulate General, Hamilton, "Questions concerning Bermuda tuna fleet's conformance with U.S. marine mammal regulations," message number 503, October 15, 1980; and U.S. Department of State, "Tuna fleet compliance with U.S. marine mammal regulations," message number 107892, April 20, 1983.

Appendix A4.--Bermuda. Large fishing vessels*

Year	Fishing Number	Fishing Capacity	Factory Number	Factory Capacity
	Number	GRT	Number	GRT
1990	3	1,481	1	706
1991	2	908	1	706
1992	2	908	1	706
1993	2	908	1	706
1994	2	908	1	706

* At least 100 GRT
Source: Lloyds's Register, *World Fleet Statistics*, various years.

Appendix B1a.--Bermuda. Fisheries catch, 1985-97

Year	Catch
	Metric tons
1985	670
1986	820
1987	820
1988	773
1989	774
1990	463
1991	428
1992	432
1993	393
1994	386
1995	444
1996	480
1997	457

Source: *Yearbook of Fishery Statistics*, various years.

Appendix B1b.--Bermuda. Fisheries catch, 1980-97

Year	Catch		Total
	Local	Distant*	
	Metric tons		
1980	547	3,526	4,073
1981	442	1,557	1,999
1982	442	1,774	2,196
1983	481	-	481
1984	486F	-	486F
1985	630F	-	630F
1986	820	-	820
1987	821	-	821
1988	773	-	773
1989	774	-	774
1990	463	-	463
1991	428	-	428
1992	432	-	432
1993	393	-	393
1994	386	-	386
1995	444	-	444
1996	480	-	480
1997	457	-	457

* These catches were associated with a Bermudian flag vessel operating in the Pacific and had nothing to do with the local fishing industry.
F - FAO estimate
Source: FAO, *Yearbook of Fishery Statistics*, (FAO: Rome, various years).

Appendix B2a.--Bermuda. Pelagic catch, 1990-97

Species	Year						
	1990	1991	1992	1993	1994	1995	1996	1997
				Metric tons				
Carangids, nei		79	56	60	59	86	70	NA
Wahoo		67	80	58	50	85	115	105
Tuna								
Albacore		NA	NA	NA	NA	NA	NA	1
False albacore*		NA	NA	NA	NA	NA	NA	6
Little tuny**		10	11	5	6	6	5	
Skipjack		Negl	Negl	Negl	Negl	Negl	Negl	Negl
Blackfin		8	6	5	7	4	3	4
Bluefin		NA	NA	NA	NA	NA	NA	2
Yellowfin		17	42	58	44	44	71	55
Marlin								
Blue		18	19	11	14	18	16	6
White		1	1	1	1	1	1	1
Swordfish		-	-	-	-	1	1	5
Sharks		12	12	14	10	17	96	NA
Total#		212	227	212	191	262	378	186

NA - Not available
* Probably little tuny
** Black skipjack
# Totals computed with available data. As the missing entries are for species normally taken in small quantities, the totals are relatively good indicators of annual catches.
Source: FAO, *Yearbook of Fishery Statistics*, various years (1990-96 data) and Department of Agriculture, Fisheries and Parks, "1997 national report for Bermuda (United Kingdom)," SCRS/98/181 (1997 data).

Appendix B2b.--Bermuda. Pelagic catch, 1990-98

Species	Year								
	1990	1991	1992	1993	1994	1995	1996	1997	1998
				Metric tons					
Barracuda	10.3	9.6	7.0	5.2	7.1	6.9	6.5	6.2	7.5
Billfish									
Blue marlin	16.8	18.4	18.7	10.9	14.5	18.7	13.4	6.4	4.6
White marlin	1.2	1.1	0.8	0.9	1.0	1.8	1.3	1.2	0.7
Dorado*	4.6	5.9	5.0	2.7	3.0	5.3	3.1	6.7	5.5
Mackerel	8.1	10.2	10.7	4.7	5.5	4.2	6.7	6.0	4.9
Oceanic bonito	0.3	0.5	0.4	0.3	0.2	0.2	0.2	0.4	0.2
Swordfish	-	-	-	-	-	0.7	0.6	0.6	8.9
Tuna									
Yellowfin	14.7	17.3	42.0	57.4	43.8	43.6	67.2	55.4	52.9
Blackfin	13.2	7.9	5.6	4.9	7.3	5.2	4.6	3.5	6.1
Albacore	0.3	0.2	0.1	0.1	Negl	0.3	0.6	0.6	1.5
Wahoo	74.2	66.8	79.7	57.8	49.5	94.2	98.6	104.6	107.8
Other**	0.1	0.1	0.1	0.1	Negl	Negl	0.3	0.1	0.1
Total	143.8	138.0	170.2	145.0	132.0	181.0	203.1	191.7	200.6

Note: Catches of bluefin tuna were reported in 1997 (~2 t) and 1998 (~1 t). The DAF informs the authors that the landings of the foreign charter vessels are included in these landings. John Barnes, Director, DAF, personal communications, September 27, 2000. The limited available data on landings separating domestic and charter vessels is presented in appendix B3b.
* Referred to as dolphin in Bermuda
** Includes bigeye tuna.
Source: Ministry of the Environment, *Marine Resources and the Fishing Industry in Bermuda*. Referred to as the Green Paper (MOE, January 2000), p. 106.

Appendix B3a.--Bermuda. Swordfish catch, 1990-98

Year	Catch		
	DAFP	FAO	ICCAT
	Metric tons		
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	-	-	-
1994	-	-	-
1995	0.7	1.0	1.0P
1996	0.6	1.0	1.0
1997	0.6*	5.0	5.0
1998	8.9	NA	NA
1999	NA	NA	NA

K - Preliminary nominal landings formally reported by national office which may not coincide with amount, time, and/or place of catch.
NA - Not available
P - Preliminary nominal landings formally reported by national office, either by formal publication or in formal correspondence.
* DAF reported a 5 t catch of swordfish for 1997 in its 1997 report provided ICCAT, which is why 5 t is reported by ICCAT and FAO. DAF Director John Barnes informs the author that their 2000 Green Paper is the best source of reliable data. John Barnes, Director, DAF, personal communications, September 26, 2000. The authors, as a result, have used the data in the MOE Green Paper (appendix B2b).
Source: Department of Agriculture, Fisheries and Parks, "1997 national report for Bermuda (United Kingdom)," SCRS/98/181 and Ministry of the Environment, *Marine Resources and the Fishing Industry in Bermuda*. Referred to as the Green Paper (MOE, January 2000), p. 106 (DAFP data); FAO, *Yearbook of Fishery Statistics*, various years (FAO data); ICCAT, *Statistical Bulletin*, various years (ICCAT data).

Appendix B3b.--Bermuda. Swordfish landings, 1995-98

Year	Vessels		Total
	Domestic	Charter	
	Metric tons		
1995	NA	NA	0.7
1996	NA	NA	0.6
1997	NA	NA	0.6*
1998	3.9	5.0	8.9
1999	NA	NA	NA

Note: The authors are unsure if the swordfish landings data shown here are reported as product-weight or live-weight equivalents.
NA - Not available
* DAF reported a 5 t catch of swordfish for 1997 in its 1997 report provided ICCAT, which is why 5 t is reported by ICCAT and FAO. DAF Director John Barnes informs the author that their 2000 Green Paper is the best source of reliable data. John Barnes, Director, DAF, personal communications, September 26, 2000. The authors, as a result, have used the data in the MOE Green Paper.
the authors have used the data provided there (appendix B2b).
Source: Ministry of the Environment, *Marine Resources and the Fishing Industry in Bermuda*. Referred to as the Green Paper (MOE, January 2000), pp. 98 and 106.

Appendix B4a.--Bermuda. Billfish catch, 1963-97

Year	Blue marlin	White marlin	Sailfish
		Metric tons	
1963	-	-	-
1964	-	-	-
1965	-	-	-
1966	-	-	-
1967	-	-	-
1968	-	-	-
1969	-	-	-
1970	-	-	-
1971	-	-	-
1972	-	-	-
1973	-	-	-
1974	-	-	-
1975	1	-	-
1976	2	-	-
1977	2	-	-
1978	5	-	-
1979	2	-	-
1980	4	Negl	-
1981	1	Negl	-
1982	2	Negl	-
1983	7	1	-
1984	8	1	-
1985	9	Negl	-
1986	11	1	-
1987	6	1	-
1988	8	1	-
1989	15	1	-
1990	17	1	-
1991	18	1	-
1992	19	1	-
1993	11	1	-
1994	15	1	-
1995	15	1E	-
1996	15K	1K	-
1997	3	1P	-

Source: ICCAT, "Report of the Standing Committee on Research and Statistics," *ICCAT Report*, Part II, 1987-97 (ICCAT: Madrid, Spain, 1998), pp. 207-211.

Appendix B4b.--Bermuda. Marlin catch, 1975-91

Year	Catch		Total
	Blue	White	
	Metric tons		
1975*	1.0	NA**	1.0
1976	1.9	NA**	1.9
1977	2.0	NA**	2.0
1978	5.0	NA**	5.0
1979	2.1	NA**	2.1
1980	3.7	NA**	3.7
1981	0.7	NA**	0.7
1982	2.0	0.2	2.2
1983	6.6	0.6	7.2
1984	8.2	0.5	8.7
1985	8.5	0.4	8.9
1986	10.7	0.7	11.4
1987	6.1	0.7	6.8
1988	8.5	0.8	9.3
1889	14.8	1.1	15.9
1990	16.8	1.2	19.0
1991	18.4	1.1	19.5

* Bermuda's compulsory fisheries data system
** Not available, but presumably no more than 0.1 t or 0.2 tons.
was introduced in 1975.
Source: Bermuda fishery statistical data base noted in Brian E. Luckhurst, "Landings of blue marlin (*Makaira nigricans*) and white marlin (*Tertrapturus albidus*) in Bermuda during the period 1975-91 with an overview of recent developments in billfishing on the island," *ICCAT Collective Volume of Scientific Papers* Vol. XLI (SCRS/92/55) (ICCAT: Madrid, 1994), pp. 222.

Appendix B5.--Bermuda. Shark landings, 1990-98

Year	Year
	Metric tons
1990	12.2
1991	12.3
1992	12.4
1993	14.1
1994	10.3
1995	16.0
1996	7.4
1997	9.1
1998	8.9

Source: Ministry of the Environment, *Marine Resources and the Fishing Industry in Bermuda*. Referred to as the Green Paper (MOE, January 2000), p. 106

Appendix B6a.--Bermuda. Landings of leased Canadian longliner Alexis I, 1997-98

Species	11/1/97			1/19/98		
	Quantity	Individuals	Average	Quantity	Individuals	Average
	Kilograms	Number	Kilograms	Kilograms	Number	Kilograms
Tunas						
Albacore	535	16	33	66	6	11
Bigeye	292	7	42	313	17	18
Bluefin	181	1	181	-	-	-
Yellowfin	962	26	37	271	15	18
Swordfish	1,774	62	29	885	28	32
Dorado*	7	1	7	36	4	9
Mako sharks	-	-	-	170	6	28
Total	3,751			1,741		

* Mahi-mahi, generally referred to as dolphinfish in the Caribbean.
Source: Joya E. Nelson, Marketing Manager, Seamont Fisheries, personal communications, August 28, 2000.

Appendix B6b.--Bermuda. Landings of leased Cuban longliner Jurel, 1998-99

Species	Quantity	
	11/1/98	4/19/99
	Kilograms	
Tunas		
Albacore	85	125
Bigeye	30	115
Bluefin	-	-
Yellowfin	160	-
Swordfish	903	344
Billfish		
Marlin	-	195
Spearfish	528	259
Dorado*	958	299
Sharks		
Bigeye thresher	NSD	
Blacktip	NSD	
Blue	7,759	
Hammerheads	NSD	
Mackerel	NSD	254
Mako	1,347	1,342
Tiger	NSD	1,901
Whitetip	NSD	230
Total, shark	17,968	3,727
Total	20,632	7,449

NSB - This species was part of the shark catch, but there is no specific data on the quantity of this species.
* Mahi-mahi, generally referred to as dolphinfish in the Caribbean.
Source: Joya E. Nelson, Marketing Manager, Seamont Fisheries, personal communications, August 28, 2000.

Appendix B7.--Taiwan. Catch composition of licenses longliners,* 1991

Species	Proportion
	Percent
Marlin	
Blue	18.2
Black	11.3
Tuna	
Albacore	15.4
Yellowfin	15.6
Bigeye	3.6
Skipjack	-
Swordfish	11.1
King mackerel	13.4
Other	11.3
Total**	100.0

* Includes fishing operations during outward voyage from St. Maarten and sets within Bermuda and surrounding waters.
** Totals may not agree due to rounding.
Source: Mr. Hasitani, Assistant General Manager, Nichirei Carib Corporation, as cited in MRAG, "Large pelagic fisheries in the Caribbean: Their role in the economies of U.K. dependent territories," report to the Overseas Development Administration, final report, June 1993, p. 56.

Appendix C.--Bermuda. Transhipments by Japanese vessels, 1969-72

Year/ month	Vessel		Destination	Quantity
	Fishing	Freezer		
				Metric tons
1969				
February	Sekisyu Maru	Fisko (Finland)	NA	413
1970				
January	Taiyo Maru No. 78	NA	Italy/Spain	
January/February	Taiyo Maru No. 77	Edogana Maru		NA
	Sekisyu Maru	Edogana Maru		NA
	Total		NA	896
February	Daishin Maru	Leopolaris (Sweden)		NA
	Mikami Maru	Leopolaris (Sweden)		NA
	Nippo Maru	Leopolaris (Sweden)		NA
	Total		NA	1,426
February	Sekisyu Maru	Scan (Sweden)		NA
	Ehiko Maru	Scan (Sweden)		NA
	Total		NA	840
March	Daishin Maru No. 15	Antoinette Castro (Spain)	NA	397
1971				
January	Sekisyu Maru	Musashino Maru		NA
	Taiyo Maru No.77	Musashino Maru		NA
	Total		NA	623
January	Daishin Maru No. 15	Trevinca (Spain)		NA
	Daishin Maru No. 16	Trevinca (Spain)		NA
	Total		NA	829
December	Taiyo Maru No.77	Hayashikane Maru		NA
	Taiyo Maru No.78	Hayashikane Maru		NA
	Total		NA	728
1972				
August	Nagasaki Maru	Juyu Maru	Vigo, Spain	800
1973-79				
	No data available			
1980-83				
	Two unidentified	NA	NA	1,000E
1984-87				
	No transhipments			

Note: The fishing vessels, primarily trawlers, were reportedly based in the Canary Islands and fished extensively on George's Bank during the late summer through the early winter. Much of the transshipments were squid, butterfish, and lobster.
E - Estimated
NA - Not available
Source: Japan Fisheries Association as reported in U.S. Consulate General, Hamilton, "Fisheries," message number 1683, March 16, 1970 and unidentified Bermudian records as reported in U.S. Consulate General, Hamilton, "Fisheries," message number A-69, November 15, 1972; U.S. Consulate General, Hamilton, "Fisheries," message number 208, August 30, 1972; and U.S. Consulate General, Hamilton, "Japanese transhipment of fish via Bermuda," message number 800, September 14, 1987.

Appendix D1a.--Bermuda. Korean swordfish catches by area and quarter, 1959-97

ICCAT Square*	Year	Quarter 1	2	3	4	Total catch
		Metric tons				
3060	1977	8.4	0.4			8.8
	1978	1.5	0.9			2.4
	1979	3.6				3.6
3065	1977	6.6	2.2			8.8
	1978	2.4	0.4			2.8
	1979	3.8	1.1		0.7	5.6
	1980	0.2				0.2
	1982	0.4				0.4
	1984	0.4				0.4
	1986	1.8				1.8
3070	1977	1.5				1.5
	1979	0.2	0.8		0.2	1.2
	1980	1.3				1.3
	1982	2.4	0.2			2.6
3560	1977	0.4				0.4
3565	1977	0.4	0.4			0.8
	1986	0.3				0.3

Source: ICCAT

Appendix D1b.--Bermuda. Japanese swordfish catches by area and quarter, 1959-97

ICCAT Square*	Year	Quarter 1	2	3	4	Total catch
		Metric tons				
3060	1963			0.3		0.3
	1964		0.7	1.0		1.7
	1965		2.6	0.4		3.0
	1966		6.0			6.0
	1967	4.1	0.5			4.6
	1968	2.0	0.3	0.3		2.6
	1969	1.5				1.5
	1970		0.3		4.0	4.3
	1971	2.8	0.1		0.1	3.0
	1972	0.6				0l6
	1973	3.9		0.2		4.1
	1978	0.1				0.1
	1981	0.1				0.1
	1982				0.4	0.4
	1986		0.3			0.3
	1987		1.1	0.1		1.2
	1988	0.1	0.6	0.1		0.8
	1989	6.7		0.1		6.8
	1990	1.4				1.4
	1991	0.1				0.1
3065	1963			0.8		0.8
	1964		1.7			1.7
	1965		6.9			6.9
	1966		2.6			2.6
	1967	1.2	0.4			1.6
	1968	0.5	0.3			0.8
	1969	0.1	0.3			0.4
	1970	0.9	0.2		1.4	2.5
	1971	6.7	0.2		0.3	7.2
	1972	1.6				1.6
	1973	0.4				0.4
	1977	0.6				0.6
	1982				0.2	0.2
	1986		0.2		1.0	1.2
	1987		0.3			0.3
	1988	0.3		0.1		0.4

	1990	0.6				0.6
3070	1963			0.2		0.2
	1964		0.7			0.7
	1965		1.9			1.9
	1966		2.0			2.0
	1967		4.2			4.2
	1968	0.1	2.9			3.0
	1969	0.1	0.4			0.5
	1970	0.1	0.4			0.5
	1971	0.8	0.9	0.6	0.4	2.7
	1972	0.3		0.2	1.0	1.5
	1973			0.5	0.4	0.9
	1974			0.2	0.3	0.5
	1975			0.2	1.7	1.9
	1976			0.4	0.3	0.7
	1977	0.3		0.1	0.1	0.5
	1978	0.2				0.2
	1986		1.5		0.7	2.2
	1987	0.5	0.9			1.4
	1988	0.1				0.1
	1991			0.1		0.1
	1996	0.3				0.3
3075	1964		1.7			1.7
	1965		7.1			7.1
	1966		9.0			9.0
	1967		0.1			0.1
	1968		0.5			0.5
	1970			0.1		0.1
	1971	0.1	0.2	0.4	2.9	3.6
	1972			1.3	0.6	1.9
	1973			0.7	0.2	0.9
	1974			1.4	0.2	1.6
	1975	0.6	0.4	1.1		2.1
	1976	1.0		0.6		1.6
	1977	2.6				2.6
3560	1962				-	-
	1964			1.2		1.2
	1965		0.1			0.1
	1966		0.4			0.4
	1967		0.1			0.1
	1970			0.1	3.1	3.2
	1971			0.1	2.3	2.4
	1973			0.9	0.3	1.2
	1974			0.3		0.3
	1975				0.9	0.9
	1976	0.1		0.3	0.6	1.0
	1977	4.9			0.8	5.7
	1978	4.8			1.0	5.8
	1979	2.7	0.5	0.2	0.4	3.8
	1980	2.6		0.6	1.9	5.1
	1981	26.4	0.1	3.8	3.1	33.4
	1982	25.7	1.7	0.1	0.2	27.7
	1983	7.0	3.7		0.4	11.1
	1984	2.0	0.7		0.4	3.1
	1985	1.9	0.7		0.7	3.3
	1986	2.9	6.1			9.0
	1987	9.9		0.1	10.3	20.3
	1988	6.1		1.5	11.6	19.2
	1989	1.1		0.4	4.2	5.7
	1990	1.5		0.1	0.1	1.7
	1991	0.2			0.2	0.4
	1994	0.1			0.7	0.8
	1995	0.5				0.5
	1996	2.0				2.0
	1997		0.1		0.3	0.4
3565	1963			0.7		0.7
	1964			0.4		0.4
	1965		8.8	0.2		9.0
	1970			0.1	0.9	1.0
	1971	0.1	1.2	8.1	32.0	47.1
	1972		0.1	1.0	0.1	1.2
	1973			2.1	3.7	5.8
	1974	3.1		1.6	1.4	6.1
	1975	0.2	0.2	0.2	5.3	5.9
	1976	9.1		4.0	3.4	16.5

	1977	41.6	0.2		45.4	87.2
	1978	10.6			1.9	12.5
	1979	14.6	0.1	0.3	0.4	15.4
	1980	2.6		0.4	0.3	3.3
	1981	1.8	0.1	2.7	12.0	16.6
	1982			0.5	1.6	2.1
	1983	7.0			0.3	7.3
	1984	2.2			0.3	2.5
	1985	3.4			0.1	3.5
	1986	4.5		0.3	3.6	8.4
	1987	6.2		0.2	6.3	12.7
	1988	4.4		0.3	5.4	10.1
	1989	0.3		0.3	1.8	2.4
	1990	0.3		0.1	0.3	0.7
	1991	0.1		0.2	-	0.3
	1994	0.1			0.1	0.2
	1997			0.1		0.1
3570	1963			0.9		0.9
	1964			0.1		0.1
	1965		6.6			6.6
	1968		0.3			0.3
	1970			1.6	22.9	24.5
	1971	3.0	8.6	37.4	100.7	149.7
	1972	0.4	5.8	35.7	32.6	74.5
	1973			10.3	86.0	96.3
	1974	2.7		6.3	10.4	19.4
	1975			7.2	27.4	34.6
	1976	6.0		10.4	20.7	37.1
	1977	0.5		1.8	34.8	37.1
	1978	33.5				33.5
	1979			0.2		0.2
	1981			0.6	0.3	0.9
	1982			0.1		0.1
3575	1970			1.4	2.8	4.2
	1971			0.2	14.5	14.7
	1972			3.2	5.6	8.8
	1973			0.3	0.4	0.7
	1974				0.3	0.3
	1975				0.4	0.4
	1976			0.2	3.1	3.3
	1977				10.6	10.6
	1978	0.9				0.9
	1981				2.2	2.2

* ICCAT square are 5° degree squares of latitude and longitude. The first two numbers are the latitude and the second two numbers are the longitude. This represents the southeastern corner of the 5° square for catches in quadrant 4, northwest Atlantic.
Note: A blank entry means no fishing was conducted. A dash indicates that there was fishing, but that there was no reported swordfish catch.
Source: ICCAT

Appendix D1c.--Bermuda. Taiwan swordfish catches by area and quarter, 1959-94

ICCAT Square*	Year	Quarter 1	2	3	4	Total catch
		Metric tons				
3060	1970	0.5				0.5
	1971	2.2				2.2
	1972	7.3				7.3
	1973	14.1			0.7	14.8
	1974	4.2			4.5	8.7
	1975	17.2			1.1	18.3
	1976	12.4				12.4
	1977	0.6			10.3	10.9
	1978	10.2			6.9	17.1
	1979	11.5				11.5
	1980	1.5				1.5
	1981	1.9	0.1			2.0
	1982	4.4	0.4			4.8

	1983	4.3			4.2
	1984	8.7	1.4		10.1
	1985	1.4		1.2	2.6
	1986	5.1	0.9	0.3	6.3
	1987	2.7	0.2		2.9
	1995	**		**	**
	1996	0.4			0.4
3065	1969	1.7			1.7
	1970	1.1	0.5		1.6
	1971	1.7			1.7
	1973	4.7			4.7
	1974	1.2		0.6	1.8
	1975	1.5			1.5
	1976	21.9			21.9
	1977	0.6			0.6
	1978	10.0	2.1		12.1
	1980	0.3	0.7		1.0
	1981	7.3	0.6		7.9
	1982	7.6	2.2		9.8
	1983	2.4	0.2		2.6
	1984	7.5			7.5
	1985	4.8		0.1	4.9
	1986	9.2	1.1	0.3	10.6
	1987	4.2			4.2
	1995	0.2			0.2
	1996	0.5			0.5
3070	1970		0.5		0.5
	1974	4.1	0.4		4.5
	1975	2.3			2.3
	1978		0.6		0.6
	1980		1.3		1.3
	1981	4.7			4.7
	1982	0.3	1.2		1.5
	1983	0.2	0.2		0.4
	1984	0.4			0.4
	1985	0.4			0.4
	1986	1.6			1.6
	1987	2.5			2.5
	1996	0.4			0.4
3560	1973			0.7	0.7
	1974			1.9	1.9
	1977			4.3	4.3
	1979			6.9	6.9
	1980	0.9			0.9
	1981	0.6			0.6
	1984			1.4	1.4
	1985	0.2		2.0	2.2
	1986	0.2		2.0	2.2
	1996	0.1			0.1
3565	1980	2.2			2.2
	1984			1.0	1.0
	1985	0.2		0.2	0.4
	1986	0.1		0.2	0.3
3570	1980	1.4	0.7		2.1

** Multiple entries were encountered. The authors are unsure as to how to treat these entries.
Source:

Appendix D1d.--Bermuda. United States swordfish catches by area and quarter, 1959-94

ICCAT Square*	Year	Quarter 1	2	3	4	Total catch
		Metric tons				
3560#	1962		1.2	5.6	4.7	
	1963		19.2	90.4	76.9	
	1964		23.4	109.8	93.4	
	1965		17.3	81.1	69.0	
	1966		9.7	45.9	39.0	
	1967		6.2	29.2	24.8	
	1968		3.3	15.5	13.1	
	1969		1.7	8.0	6.8	
	1978		55.1	259.3	220.5	
	1979		71.0	333.8	283.9	
	1980		91.6	430.6	366.2	
	1981		72.8	342.3	291.0	
	1982		96.2	452.6	384.8	
	1983		82.3	387.2	329.3	
	1984		85.2	400.6	340.7	
	1985		84.8	398.6	338.9	
	1986		93.9	441.6	375.5	

Note: The authors encountered apparent statistical problems with the U.S. data on the ICCAT web site beginning in 1987. As a result this data was not added to this appendix.
10° by 20° square
Source: ??

Appendix D2a.--Bermuda. Licenses for foreign fishing vessels

Year	Country: Canada	Japan	Korea	Taiwan	U.S.	Other**	Total
			Licenses				
1975							
1976							
1977							
1978							
1979	NA	UN	UN	UN	NA	NA	40E
1980	NA	UN	NA	UN	NA	NA	40E
1981							
1982							
1983							
1984							
1985							
1986							
1987	-	-	-	33	-	-	33
1988							
1989							
1990							
1991							
1992							
1993	UN						
1994	7#			10			
1995							
1996	1#						
1997	1#						
1998	1#						
1999						1##	

Note: The Bermuda Government has not released detailed data on its licensing program to the public.
NA - Not available
UN - The number is unknown, but some longline licenses were known to have been issued.
** Including Denmark (Faroes Islands).
# Canadian charter vessels
Cuban charter vessel--*Jurel*
Source: Various press source.

Appendix D2b.--Bermuda. Fishing licenses for foreign vessels*, 1978-95

Country	Year								
	1978	1979#	1980	1981-90	1991	1992	1993	1994	1995
	Vessels								
Taiwan	7	26	NA	NA	10	10	10***	3	-
Korea	9	10	NA	NA	-	-	-	-	-
Faroes Islands	-	2	NA	NA	-	-	-	-	-
Japan	-	1	-	NA	-	-	-	-	-
Canada	-	-	-	-	-	-	-	7	-
United States	-	-	NA	NA	-	-	1	-	3
Total	16	39**	40E	NA##	10	10	11	10	3

E - Estimate
NA - Not available
* Mostly longliners
** All longliners
*** Most of these vessels were chartered by a Japanese company.
# Sources vary slightly in the number of 1978 licenses.
This data is not public information in Bermuda. The authors requested the data from the DAF, but DAF Director John Barnes indicates that he was unable to obtain the necessary clearances to release the data for publication. John Barnes, DAF, personal communications, September 22, 2000.
Sources: U.S. Consulate General, Hamilton, "Japanese tuna fishing off Bermuda," message number 575, October 30, 1979; U.S. Consulate, Hamilton, "No apparent Soviet-Bermuda fishery relations," message number 181, February 28, 1989; Colin H. Benbow and James Burnett-Herkes, "Island nation management of extended jurisdiction," *Proceedings of the Gulf and Caribbean Fisheries Institute*, Vol. 32, November, 1979 (GCFI: Miami, Florida, 1980), p. 61; Charles W. Moore, "Bermuda wants the Canadians back," *Atlantic Fisherman*, August, 1994, p. 13; and John A. Barnes, Director, Department of Agriculture, Fisheries and Parks, personal communications, February 6, 1996.

Appendix D3c.--Bermuda. Foreign fishing licenses, 1990-99*

Year	Licenses
	Number
1990	13
1991	10
1992	10
1993	10
1994	10
1995	3
1996	-
1997	-
1998	-
1999	-

Note: Foreign vessels working under charter arrangements are not included here.
* Through August
Source: Ministry of the Environment, *Marine Resources and the Fishing Industry in Bermuda*. Referred to as the Green Paper (MOE, January 2000), p. 19.

Appendix E.--Bermuda. Market prices of pelagic fish, 1999

Species/ product	Roadside	Wholesale Fresh	Wholesale Frozen	Retail
		US$/pound		
Local				
Wahoo				
Whole	-	5.00-7.00	-	-
Fillet	8.00-9.00	-	-	9.50-10.50
Tuna				
Fillet	6.00-8.00	-	-	-
Other	-	5.00	-	-
Dorado	-	-	4.00-5.00	-

Source: Ministry of the Environment, *Marine Resources and the Fishing Industry in Bermuda*. Referred to as the Green Paper (MOE, January 2000), p. 195.

Appendix F1.--World. Swordfish imports from Bermuda, 1990-99

Country	Year 1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
					Metric tons					
European Union	NA	-	-	-	-	-	-	-	-	-#
Japan	-	-	-	-	-	-	-	-	-	-
United States	-	-	-	0.5	12.4	-	-	-	-	-
Other*	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	0.5	12.4	-	-	-	-	-

NA - Not available
* Shipments to other countries are believed to be nonexistent.
# Preliminary
Source: EU, NIMEXE; Japan Tariff Association, and U.S. Bureau of the Census.

Appendix F2a1.--United States. Swordfish imports from Bermuda, 1985-2000

Year	Commodity Fresh	Commodity Frozen	Total*
	Metric tons		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985**	-	-	-
1986	10.8	-	10.8
1987	-	-	-
1988	-	-	-
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	0.5	-	0.5

1994	12.4	-	12.4
1995	-	-	-
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999			
2000	-***	-***	-***

* Totals may not agree due to rounding.
** No swordfish imports were reported before 1985.
*** Through June.
Source: U.S. Bureau of the Census

Appendix F2a2.--United States. Swordfish imports from Bermuda, 1985-2000

Year	Commodity		Total*
	Fresh	Frozen	
	US$1,000		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985**	-	-	-
1986	41	-	41
1987	-	-	-
1988	-	-	-
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	3	-	3
1994	132	-	132
1995	-	-	-
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999			
2000	-***	-***	-***

* Totals may not agree due to rounding
** No swordfish imports were reported before 1985.
*** Through June
Source: U.S. Bureau of the Census

Appendix F2b.--United States. Monthly swordfish imports from Bermuda, 1990-2000

Month	Year										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
					Metric tons						
January	-	-	-	-	-	-	-	-	-	-	-
February	-	-	-	-	8.4	-	-	-	-	-	-
March	-	-	-	-	3.6	-	-	-	-	-	-
April	-	-	-	-	0.3	-	-	-	-	-	-
May	-	-	-	0.5	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-	
August	-	-	-	-	-	-	-	-	-	-	
September	-	-	-	-	-	-	-	-	-	-	
October	-	-	-	-	-	-	-	-	-	-	
November	-	-	-	-	-	-	-	-	-	-	
December	-	-	-	-	-	-	-	-	-	-	
Total*	-	-	-	0.5	12.4	-	-	-	-	-	-

* Totals may not agree due to rounding.
Source: U.S. Bureau of the Census

Appendix F2c.--United States. Tuna imports from Bermuda, 1990-2000

Year	Species*				Total**
	Albacore	Bluefin	Yellowfin	Unknown	
		Metric tons			
1990	-	-	-	-	-
1991	-	-	-	-	-
1992	-	-	-	-	-
1993	2.4	-	-	-	2.4
1994	4.6	0.3	1.0	0.3	6.3
1995	-	-	-	-	-
1996	-	-	-	-	-
1997	-	0.4	0.9	-	1.3
1998	-	-	-	-	-
1999	-	-	-	-	-
2000	-***	-***	-***	-***	-***

* All the reported shipments are fresh product.
** Totals may not agree due to rounding.
*** Through June.
Source: U.S. Bureau of the Census

Appendix F2d.--United States. Fishery imports from Bermuda, 1980-99

Year	Species									Total
	Tuna	Swordfish	Groundfish	Salmon	Other fish	Crab	Lobster	Mollusks	Turtles*	
					US$1,000					
1980	-	-	-	-	-	0.5	-	-	-	0.5
1981	520.6	-	-	-	-	0.9	-	-	-	521.5
1982	448.5	-	-	-	-	-	-	-	-	448.5
1983	2.4	-	-	-	-	-	2.9	-	-	5.3
1984	3.8	-	0.9	5.6	-	-	-	-	-	10.3
1985	-	-	-	-	-	-	32.0	-	-	32.0
1986	-	41.0	-	-	-	-	42.0	-	25.0	108.0
1987	-	-	-	-	-	-	-	-	5.5	5.5
1988	-	-	-	-	-	-	-	-	-	-
1989	-	-	-	-	-	-	-	-	-	-
1990	-	-	-	46.8	-	2.0	-	-	-	48.6
1991	-	-	-	-	-	-	-	1.7	-	1.7
1992	-	-	-	-	-	-	10.5	-	-	10.5
1993	8.6	3.2	-	-	-	-	-	-	-	11.8
1994	43.5	131.9	-	-	-	-	-	-	-	175.4
1995	-	-	-	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-	-	-
1997	4.9	-	-	-	-	-	-	-	-	4.9
1998	-	-	-	-	-	-	-	-	-	-
1999	-	-	2.5	-	-	-	-	-	-	2.5

* Live
Source: U.S. Bureau of the Census.

Appendix F3.--European Union. Swordfish imports from Bermuda, 1991-99

Country	Commodity	Year								
		1991	1992	1993	1994	1995	1996	1997	1998	1999*
				Metric tons						
All	Fresh	-	-	-	-	-	-	-	-	-
	Frozen	-	-	-	-	-	-	-	-	-
Total		-	-	-	-	-	-	-	-	-

* Preliminary
Source: EU. NIMEXE

Appendix G. Bermuda Game Fishing Association tournament schedule, 1999

Date	Organising Group	Category
MAY	Blue Water Anglers Club Invitational Tournament	Members Only
	Spanish Point Boat Club Light Tackle Tournament (Fish one of two days only)	OPEN
JUNE	Bermuda Anglers Club Annual Tournament	Members Only
	Spanish Point Boat Club Tuna Tournament	Members Only
	Blue Water Anglers Club Member/Guest Tournament	Members & Guests
	Sea Horse Anglers Club Swordfish Tournament	OPEN
	Bacardi Rum Fishing Tournament	Bermudian Residents
	Blue Waters Anglers Club Father/Son/Daughter Tournament	Members Only
JULY	Bermuda Regiment Annual Tournament	OPEN
	Bermuda Anglers Club Invitational Light Tackle Tournament	Invitational
	Blue Waters Anglers Club Vs Boston Sea & Surf	Members Only
	Bermuda Game Fishing Clubs Annual Tournament	IGFA Affiliated Clubs
	Blue Water Anglers Club Member/Guest Tournament	Members & Guests
	Sea Horse Anglers Club Bill Fish Tournament	OPEN
AUGUST	Blue Waters Anglers Club Ladies Auxiliary Tournament	Members Only
	Flybridge Tackle Junior Tournament	OPEN
	Blue Waters Anglers Club Junior Tournament	OPEN
SEPTEMBER	Sea Horse Anglers Club Annul Tournament	Members Only
	Mid Ocean Wahoo Tournament	Bermuda Residents
	Blue Water Anglers Club Presidents Vs Vice Presidents	Members Only

Ministry of the Environment. *Marine Resources and the Fishing Industry in Bermuda.* Referred to as the Green Paper (MOE, January 2000), p. 167p.

6

BRITISH VIRGIN ISLANDS

The British Virgin Islands has only a small fishing industry. The fishery is largely artisanal and recreational and based on multi-species resources taken in shallow water. Catches have been declining in recent years. Officials as elsewhere in the Caribbean would like for the fishermen to diversify operations away from the heavily fished demersal resources. Various assessments of the BVI fishery suggest that the islands could support a small fishery for oceanic pelagics. Fishing effort of foreign fishermen substantiate that swordfish and other oceanic pelagics are present in BVI waters and in adjacent Atlantic Ocean waters to the north of their EEZ. Several BVI fishermen in the mid-1990s attempted to initiate pelagic longline operations, but most experienced difficulties. One fisherman reports small catches and continues to operate his longliner. The catch is marketed domestically. BVI fishermen after the disappointing results in the mid-1990s have shown little interest in entering the longline fishing levels. Bait imports, however, suggest there may be some increased fishing activity in 1999 and 2000.

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Figure 1.--Map of the British and United States Virgin Islands.

I. Overview

A. Background

The British Virgin Islands (BVI) were discovered by Columbus on his second voyage in 1493. They were not settled until 1648 when Dutch settlers arrived. The islands were then taken over by English planters in 1666. The Crown granted constitutional government in 1774, just as the Revolutionary War was looming in North America. The BVI was part of the British Leeward Islands from 1872 to 1956 when it became a separate administrative unit. Because of its close association with the U.S. Virgin Islands, the BVI did not join the short-lived West Indies Federation (1958-62).

The BVI remain a stable British territory which has wide-latitude in its internal self-government and little apparent interest in independence, reflecting an appreciation of economic realities. Representative government was initiated in 1950 and a Constitution granted in 1967 which introduced a ministerial system of government. The Constitution was amended in 1977. The Governor appointed by the Crown is responsible for defense and internal security, external affairs, the public service, and the courts. Government affairs are conducted by an Executive Council and popularly elected Legislative Council. The island's small population is primarily interested in economic development and self sufficiency before seriously considering any change in its political status.

The BVI is located about 80 kilometers (km) east of Puerto Rico and 225 km northwest St. Christophers. The BVI are separated from the U.S. Virgin Islands (USVI) by a narrow strait east of St. John. The BVI itself consists of about 60 islands, islets, rocks and cays of which 16 are inhabited--although less than 1,000 inhabitants are found on several of the islands. The count of islands varies, depending on the size selected as there are a large number of small rocks and shallow reefs. Most of the residents live on the main island of Tortola, but other important islands include Virgin Gorda, Anegada, and Jost Van Dyke. Most of the islands, except for Anegada, are clustered together. Anegada is located to the northeast of the other islands. The economy of Anegada is almost entirely dependent on fisheries.

The BVI has little arable land, limited precipitation, and no important natural mineral or other resources. The magnificent natural setting, however, has proven to be the most important resource and supports the tourist industry. Tourists are attracted by beautiful beaches, excellent sailing, and some of the best sport fishing in the Caribbean. In recent years, financial services has become an important economic activity. Another principal economic sector is fisheries, utilizing one of the island's few renewable natural resources--its marine resources.

B. Fishing industry

The BVI artisanal fishery until the mid 1970s was largely disorganized and unregulated. The fishermen have access to a somewhat limited resource. Fishery resources in the northeastern Caribbean from Puerto Rico to Antigua appear relatively scarce.[1] Even so, the BVI's population is small and the shelf on which the island sits provides a number of shallow areas and banks that the inshore fishermen target. Fishermen take a variety of demersal species as well as crustaceans and mollusks like lobster and conch. These inshore demersal species are heavily fished. One 1991 study suggested that as a result of overfishing, the annual catch is substantially below the optimal sustainable yield (OSY).[2] While the demersal resource is heavily exploited, the same is not true of pelagic resources. Pelagic species are also available in offshore waters, but are only lightly fished by domestic

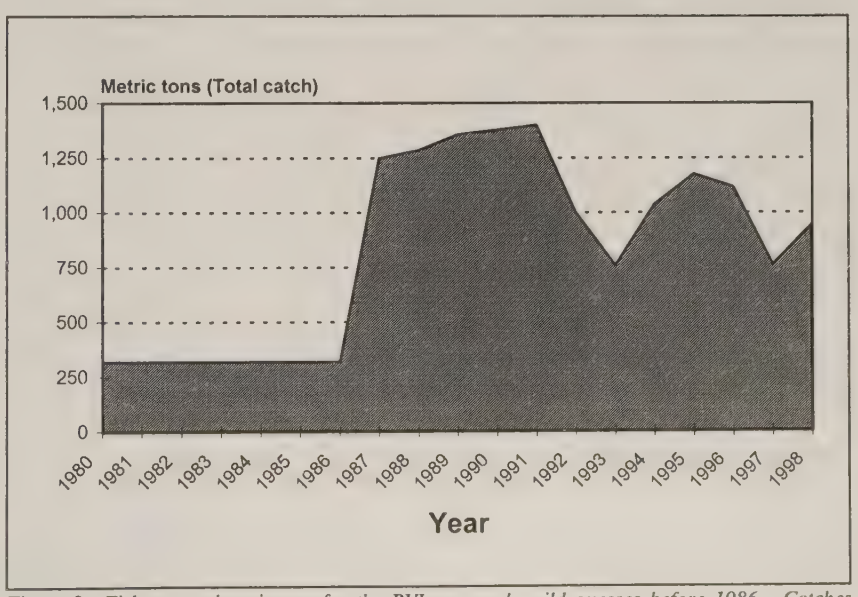

Figure 2.--Fishery catch estimates for the BVI were only wild guesses before 1986. Catches appear to have declined sharply in the early 1990s.

fishermen. Observers believe that the catch of wahoo, dorado (dolphin), king mackerel (kingfsh), and little tuna (tuny) could all be increased. Some observers have suggested that fisheries for these coastal pelagics should be increased to relieve pressure on heavily fished demersal species like snapper and grouper.[3]

BVI fishermen until recently primarily fished for subsistence. After the British declaration of a 200-mile fishing zone in 1977 and requests for assistance from local fishermen, the BVI Government initiated a fisheries development project in the late 1970s. The BVI Government has attempted to regulate the fisheries and collect statistics, but only with partial success. The BVI fishery in the 1980s developed into a more commercially oriented, but still small-scale operation. A 1983 study report by BVI officials indicated that the fishery was conducted by about 180 fishermen (over half part-timers). Most of the fishermen deploy traps or nets with a smaller number using hook and line.

The BVI fisheries catch is quite small. One report suggests that fishermen landed only about 635 metric tons (t) during the early 1980s.[4] FAO suggests lower catches of only a little over 300 t (appendix B1). The catch appears to have peaked at about 1,400 t in 1991 and has since declined to less than 1,000 t in 1997. Much of the catch data available for the BVI, however, is only rough estimates. Actual catches may be somewhat higher if landings by subsistence and recreational fishermen were added.

The great bulk of the catch is sold at convenient places near landing sites. Lesser quantities are sold directly to hotels, the BVI Fishing Company, or exported. Most exports are marketed in Puerto Rico and the U.S. Virgin Islands (USVI), both St. Croix and St. Thomas. Exports are shipped by both air and sea.

II. Species

The authors have little data on swordfish behavior in BVI waters. The limited BVI longline catch data suggests that the best catches are reported from October through February, with April also important (appendix C2).

A. Spawning

The spawning grounds for swordfish are primarily deduced by the location and abundance of swordfish larvae. One 1983 study reported that there is relatively little spawning within the Caribbean itself, although some limited spawning does take place south of Cuba. Considerable spawning activity is reported off western Cuba, both in the Yucatan and Florida straights (Cuba, figure 4). There is also some spawning around the Lesser Antilles, primarily from north of Anguilla to St. Lucia.[5] Researchers have identified the Anegada Passage and northeast of the Lesser Antilles where mature fish are present and spawning may be occurring.[6] Larvae are reportedly abundant east of Puerto Rico and south of the U.S. and British Virgin Islands. The larvae found in the Lesser Antilles are both small and large sized. The lesser numbers of small larvae suggest that spawning is less intense than in the western Caribbean off Cuba. The numbers of large larvae suggest that spawned larve are retained there or recruited from adjacent regions.[7] A 1998 study reported similar results (Venezuela, figure 10).[8]

B. Migration

The best evidence on swordfish movements comes from tagging. Tagging swordfish, however, has proved to be a difficult proposition. One of the biggest is the small number of fish taken by the catch and release recreational fishery. The limited number of tag returns suggest a movement of swordfish from the Caribbean sill to and from the northwest Atlantic. One tag was reportedly retrieved by the *Argus III* in June off Anegada. The fish had been tagged in the northwest Atlantic. In the 9 month period the fish had grown from 12 to 23 kilograms[9] The authors are unsure just which tag the *Argus III* retrieved. Available tag returns show that several swordfish have been tagged off New England and the Grand Banks and retrieved in the northeast Caribbean (Caribbean Overview, appendix C3). Five swordfish have been tagged south and southwest of the BVI in the Caribbean. Three were retrieved off New England and one on the Grand Banks (figure 3). Another was retrieved at about the same latitude northwest of the Cape Verde Islands.[10] The fish tagged east of the BVI in the Atlantic were also mostly retrieved off New England and the Grand Banks (figure 3). One fish, however, was retrieved off Haiti in the Windward Passage (Haiti, figure 3). While the migratory movement of swordfish are still quite speculative, the tag results and accompanying time interval data are consistent with the postulated track of following the

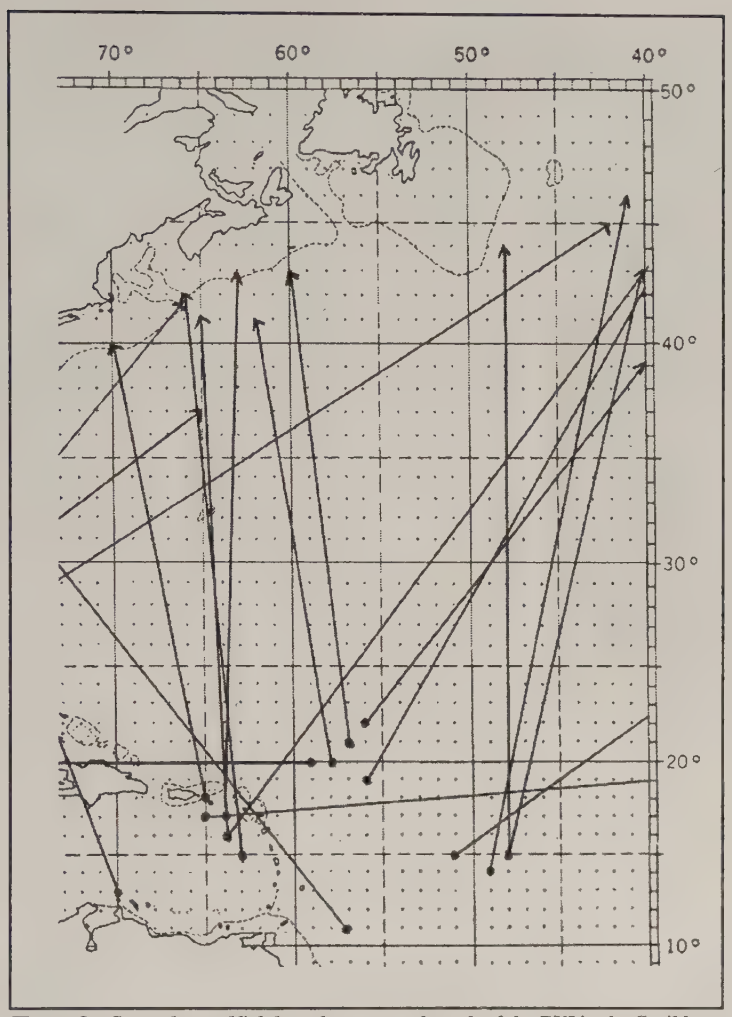

***Figure 3.**--Several swordfish have been tagged south of the BVI in the Caribbean as well as east in the Atalntic. Large numbers appear to seasonally migrate north to feeding grounds off the U.S. and Canada.*

north Atlantic Subtropical Gyre in a clockwise seasonal migration.[11] One interesting observation is that the further west the fish were tagged in the wider-Caribbean, the more likely they were to be retrieved along the U.S. coast. The further east they were tagged in the Atlantic beyond the Antillian Arc, the more likely the fish were to be retrieved east of the Grand Banks. A similar phenomenon can be observed for swordfish on southbound migrations. While the number of tag returns is still quite small, the pattern is notable. The development of new archival tags will provide much more information on swordfish migratory movements in the next few years.

C. Seasonality

Available data suggests that swordfish are present year round. The best catches, however, are generally reported during the last few months of the year or at the beginning of the year. Limited data from BVI operations show good catches from October through February (appendix B2). BVI catch data, however, may be affected by market trends with less demand and thus reduced fishing effort during the off-season for the tourist industry. Data from U.S. swordfish longliners suggests that the best swordfish catch rates around the BVI were achieved November to April.[12] In one respect this is advantageous to any local fishery in that it coincides with the seasonality of the tourist industry, meaning that there would be a strong market for fish landed during this period, both on the BVI and the USVI. U.S. catch data also provides data on the seasonality of swordfish in the northeast Caribbean (Caribbean Overview, appendix D8a).[13] Data is also available from the Japanese, Korean, and Taiwan fleets, but as swordfish was not the target species, some care must be taken in using this data (Caribbean Overview, appendices D4, D5a, and D7a). The foreign data shows that swordfish are present in the northeastern Caribbean where the BVI is located (ICCAT square 1560) year round. The fact that in most years fishing was not continuous year round makes it difficult to discern a seasonal pattern from the available foreign catch data (appendix B3). Available data from the U.S. fleet shows that the first quarter of the year was consistently the most productive (Caribbean Overview, appendix D8a).

Photo 1.--This photo was taken from the north coast of Thatch Cay (USVI). The British Virgin Islands are to the left and St Johns to the right. Albert Theberge, NOAA Library

coral reefs which over the years have caused more than 300 ship wrecks. These wrecks have been incorporated into the reefs by coral growths and now, despite the many tragedies involved, have become an attraction for divers.

John Van Dyke: John Van Dyke Island lies to the north of Tortola's West End. It is named after a Dutch pirate who once sheltered there.

Tortola: Tortola is the largest of the British Virgin Islands and overlooks the Sir Frances Drake Channel. It is situated about 95 km east of Puerto Rico and only a few km from St. Thomas in the U.S. Virgin Islands, making it easily accessible to tourists. Road Town, the capital and main port of the BVI, is located on Tortola. Except for a few seasonal springs and streams on Tortola, most of the BVI's water supply comes from wells and rainwater catchments.

Virgin Gorda: Virgin Gorda is named for a protruding mountain noted by Columbus. It is the second largest of the BVI islands and noted for its yacht clubs.

III. Grounds

A. Oceanography

The BVI sits on the same ocean shelf as the U.S. Virgin Islands and Puerto Rico. Anegada, one of the major islands of the BVI is on the windward edge of the Caribbean ledge or shelf. The North Drop area, just north of Anegada and Horseshoe Reef, is an area where the water falls sharply from about 50 meters (m) to over 350 meters. Dense schools of squid and flyingfish congregate in the area above the numerous undersea canyons to feed in the nutrient-rich upwelling areas. They serve as fodder species for oceanic predators like tuna, billfish, and swordfish as well as well as blackfin, wahoo, and dorado.[14] This makes BVI waters one of the most popular sites for sport fishing, especially by the large sport fishing fleets located in nearby Puerto Rico and the USVI.[15]

B. Topography

The BVI consists of a group of over 50 small coral and volcanic islands. The coral islands are relatively flat while the volcanic islands are steep and hilly. The population is limited by the small size of the islands and the limited freshwater.

Anegada: The small, flat island of Anegada lies about 30 km north of Virgin Gorda. Anegada is encircled by

The BVI while consisting of extremely small islands, forms the eastern extremity of the Greater Antilles. The BVI shares a common shelf with the BVI and Puerto Rico. Anegada is located at the extreme northeast corner of that shelf. The BVI is separated from the Lesser Antilles to the east and south by the Anegada Passage, the deepest cut in the exterior sill forming the Caribbean Sea (Caribbean Overview, appendix B1).

The Atlantic ocean floor falls off steeply north and east of the BVI. Some of the deepest water of the Puerto Rican Trench is about 125 km north of Anegada. Deep water is located even closer east of Anegada. In between Anegada and the other BVI islands is a fairly large area of shallow-water shelf. BVI fishermen (artisanal, commercial, and recreational) thus have access to widely diverse marine ecosystems and the diverse species which inhabit them.

C. Fishing grounds

The BVI artisanal fishery is conducted in the shallow waters on the shelf shared with the United States Virgin Islands (USVI) and Puerto Rico. The BVI Exclusive Economic Zone (EEZ) consists of about 73,800 square kilometers. The EEZ extends fully 200 miles north into the Atlantic Ocean, but the projection west and south is limited by the USVI EEZ and east by Anguillian EEZ. Most of the BVI artisanal catch is

taken on the shallow shelf in waters of 70 meters or less.[16] Pelagic longlining is the principal fishery conducted in offshore waters.

Data from foreign longliners show that longlining is feasible around the BVI. More effort appears to occur east of the Antillian Arc than immediately around the BVI and neighboring islands, although fishing patterns vary over time (figure 7).[17] The three major Asian longlining countries report swordfish catches in the northeastern Atlantic (appendix B3). U.S. longliners operated out in the Atlantic north and east of the BVI. Some U.S. longline, especially the ones that were based in St. Croix (USVI) operated to the south within the Caribbean basin (figure 7).[18] U.S. swordfish longliners suggests that commercial longlining in productive, especially from November to April.[19] The interest of Taiwan longliners in BVI licenses confirms that oceanic pelagics are present in commercial quantities within the BVI EEZ.[20] Precise details are not available, but presumably the Taiwan fishermen have encountered fishable stocks in the outer regions of the EEZ as they have not been seized by BVI authorities in the inshore waters that are normally patrolled. The BVI location northeast of the USVI provide it with an EEZ that projects out into the Atlantic. The one commercial longliner (*Argus III*) currently active in the BVI rarely fishes more than 4-5 days from the island, usually in the Atlantic north of Anegada and northeast of Tortola.[21] Test fishing by the Anguillian Offshore Fisheries Development Project un 1998-99 provides some useful information on potential longline catches in neighboring BVI waters.[22]

IV. Fleet

A. Domestic fleet

The domestic BVI fishing fleet is primarily an artisanal fleet, but there is also a small commercial fleet as well.

Artisanal: BVI fishermen according to a 1983 report use small boats, most of which (about 90 percent) are 8 m or less in length and have wooden hulls. The vessels are generally powered by outboard gasoline motors. Fishermen in 1983 added six fiberglass boats nearly 9 m in length with inboard diesel engines.[23] One report indicated that the fleet in the early 1990s consisted of about 150 craft. Another report indicated that in 1991 there were about 140 artisanal boat and more than half the fleet was of fiberglass construction. More than 80 percent of the fleet was composed of boats 7.5 m or less.[24] The BVI fleet is largely deployed in trap fisheries. The artisanal fleet appears to be badly over capitalized. Most observers believed that the catch could actually be increased by reducing the number of boats. One unpublished Department of Conservation and Fisheries (DCF) study suggested reducing the number of vessels by 60 boats.[25] The BVI was struck by Hurricane Luis in 1995 and suffered enormous destruction. The fishing industry was devastated. Many artisanal fishing vessels were destroyed.[26]

Commercial: One 1995 report suggests that there were about six longliners in the BVI, but not all were active. Overly optimistic plans were reported by several fishermen to initiate operations in 1996. Fishermen in early 1996 were reportedly preparing another vessel, the 19.8 m *Ms. Wendy S* for longlining operations later in the year. Another fishermen reported in 1995 that he lost his mainline during fishing operations.[27] These ventures proved unsuccessful (appendix A). Reports from the BVI in 1999 suggest that there is currently only one active commercial longliner, the 14.6 m *Argus III*. The vessel is 7-years old motorized yacht with a 4.7 t hold.[28]

B. Foreign fleet

Some foreign vessels have fished with BVI licenses. One 1990 report suggested that some U.S. longliners targeting swordfish fish out of Tortola.[29] These vessels were not based in Tortola, but did obtain BVI licenses and were required by BVI regulations to deliver their by catch to the British Virgin Islands Fishing Company (BVIFC).[30]

C. Recreational fleet

The authors have received a variety of estimates on the number of active BVI sport fishing boats. A 1996 estimate reported three or four charter boats targeting billfish.[31] A 2000 estimate reported five or six charter boats.[32] About 10 other privately owned boats occasionally target billfish and other recreational species. Many of the available charter boats are about 10-12 m long. Some of the larger charter boats, like the *Whopper* are about 14 m in length.[33] Another charter operator has a Hatteras 14-m boat, the *Basic Lady*.[34]

V. Shipyards

The authors have little information on shipyards on the BVI. There is reportedly one commercial shipyard on the BVI which produces fiberglass vessels.[35]

VI. Fleet Operations

A. Commercial fishery

There is no large-scale commercial fishery in the BVI. A few fishermen, however, have conducted longline operations since 1984. They have deployed small longliners in 5-10 day trips.[36] These fishermen have reported catches of pelagic species, including swordfish, tuna, dolphin, bonito, wahoo, shark (mako and blue), marlin, and escolar.[37] The principal target species, however, has been swordfish which constitutes the bulk of the catch (appendix B2). Only limited information is available on fleet operations. The small longliners which operated briefly during the mid-1990s reportedly landed about 0.17-0.27 t annually which the owners marketed domestically.[38]

The most successful BVI commercial longliner in the 1990s has been the *Argus III* operated by Neptune's Treasure which is owned by the Soares family. The vessel deploys a 50-km mainline on 4-5 day trips, usually in the Atlantic north of Anegada and northeast of Tortola. The vessel is crewed by three people, two brothers and a friend. Vessel operations are highly seasonal. When swordfish catches decline the vessel may be used for limited demersal operations targeting snapper, grouper, lobster, and other species. The vessel is often idle from June to October. This is the off season in the island's tourist industry and without the tourists there is little demand for expensive fish like swordfish and tuna. None of the catch is currently being exported. The hooks are commonly set at depths up about 25 meters. Light sticks are used in every hook. They use different colors (green, blue, and yellow), depending on availability. They use frozen squid imported from Florida, Canada, or Argentina for bait.[39] The catch includes swordfish, tunas, dorado (mahi-mahi), escolar, marlin, and sharks. They have taken as many as 20 swordfish a day, but usually average about 10 day. During the peak swordfish season they may take only 2-3 tunas, but during the peak tuna season catches may exceed 20 tunas daily. The swordfish average about 45 kilograms. Several different sharks are taken, but generally only mako and threshers are retained.[40]

B. Artisanal fishery

BVI artisanal, or small-scale commercial fishermen, primarily work on the shelf in waters no deeper than about 70 meters. The multi-gear fisheries take a variety of species. About 280 fishermen were active in the early 1990s, about half of which owned boats.[41] The fishermen use a variety of gear, including traps, handlines, beach seines, gillnets, and spear guns. Trap fishing is the most common fishing method. The fishery until the early 1980s was largely focused on shallow-water reef species. The 9-m

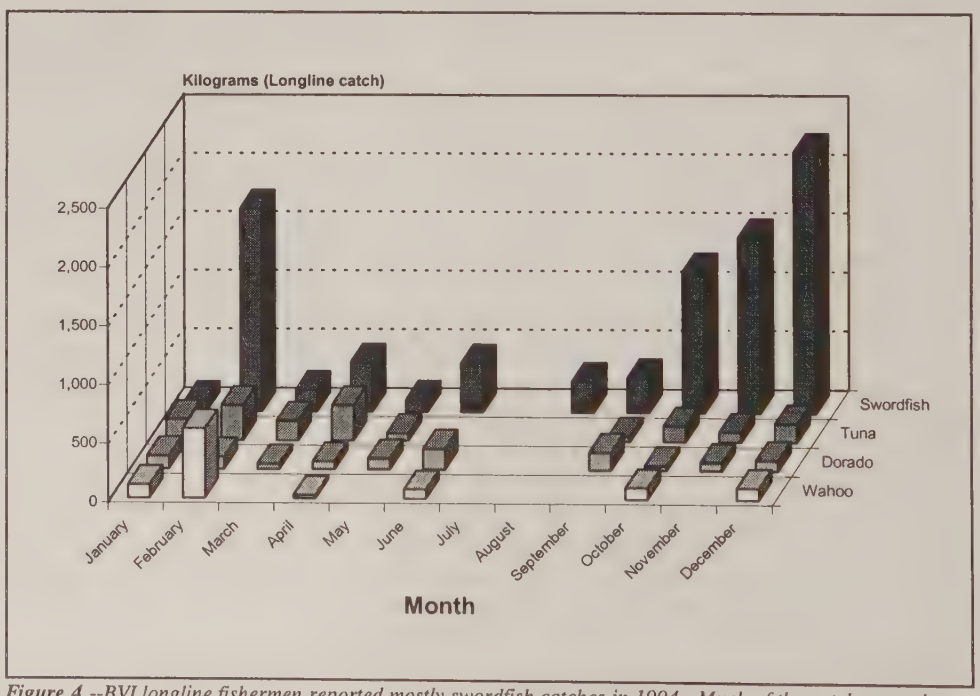

Figure 4.--BVI longline fishermen reported mostly swordfish catches in 1994. Much of the catch was taken at the beginning and end of the year. Small quantities of tuna, dorado, and wahoo were also taken.

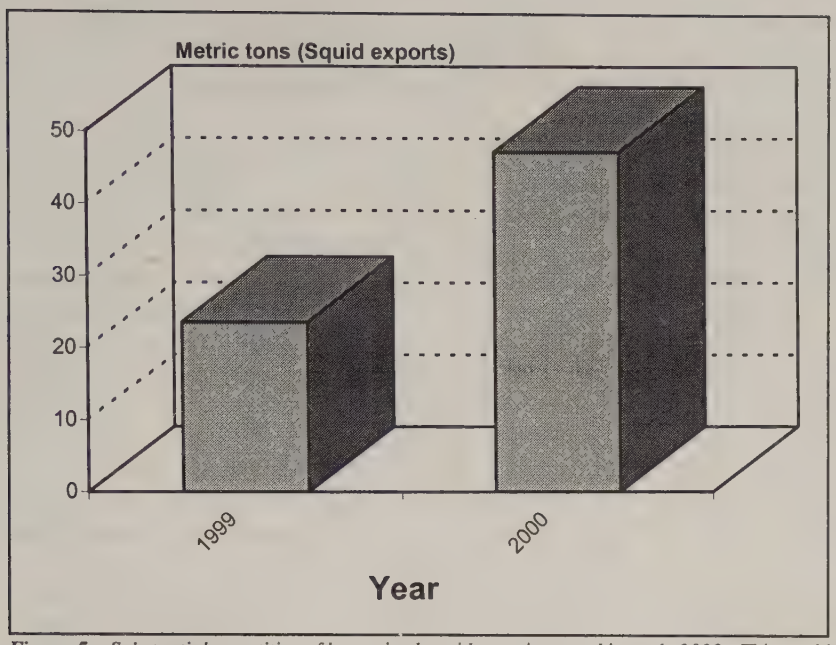

Figure 5.--Substantial quantities of low-priced squid were imported in early 2000. This could be bait for the longliners who often use squid when fishing for swordfish.

fiberglass boats acquired in 1983 enabled trap fishermen deeper-water stocks on the shelf edges where they were previously unable to access.[42]

C. Recreational fishery

The BVI tourist industry, while important to the economy, is much smaller than that of the USVI--primarily because far fewer tourists visit the BVI. One tourist magazine calls the BVI, "nature's little secrets" and states, "... the BVI has succeeded in safeguarding their special charm from the inroads of mass tourism". At a result, the BVI has a more limited local sports fishing industry. USVI boats, however, are reportedly very active in BVI waters.

The local recreational fishery is promoted by the BVI Yacht Fishing Club. One study estimated that in 1991 there were 127 boats involved in recreational fisheries. Nearly half of these boats or 54 targeted big game species likes billfish. About 80 percent of the boats targeting big game species were foreign boats, mostly operating from the USVI.[43] One 1989 report indicated that 3 or 4 sports vessels were available for offshore sports fishing. A more recent report indicates that in 1996 there were 4 charter boats available.[44] The BVI sport fishing boats operate from several different islands. Tortola has about 2 charter boats. Virgin Gorda has three charter boats. Anegada has one charter boat.[45]

BVI officials license foreign recreational fishermen. Revenue from those licenses is minor, only about $12,500 in 1991.[46] One estimate suggested catches in 1991 totaled around 190 t, about half of which were blue marlin and the other half a variety of different pelagics, including mackerels, barracuda, wahoo, and bonitos.[47] One assessments of the fishery prepared for the BVI Government recommended that BVI substantially increase licensing fees, limit foreign boats, and double fees if the catch is landed outside the BVI.

The first BVI sports tournament was not held until 1968. The most important tournament is now the International Billfish Tournament organized by the Angler's Club. Many boat operators still commonly participate in the better known tournaments held in the USVI.[48] The charter operators all conduct tag and release fishing.[49] The principal marina is the BVI Yacht Club at Road Town on Tortola.[50] The charter boats mostly use 80 pound Penn International tackle.

Several species are taken in the sport fishery. The most important billfish is blue marlin, but some white marlin and sailfish are also taken.[51] Other species include king mackerel, skipjack tuna, bonefish, wahoo, dorado, and others.[52] Few of the recreational anglers report swordfish strikes.

The sport fishery in the BVI is highly seasonal, although there are some variations and differences of opinion. A published source suggested that blue marlin is generally taken from March through May.[53] One charter boat operator reports that the best season for blue marlin is generally the summer between June and October, peaking in August. He has observed changes in the seasonality of the fishery in recent years, better catches beyond the normal summer season. Sailfish are sometimes taken in the colder months, especially December and January.[54] Another observer reports that the best marlin fishing is during July and August.[55]

While the BVI sport fishing industry is small, actual sport fishing operations conducted in BVI waters are much more extensive. One British study claims that much of sport fish taken in BVI waters are taken on boats based in the nearby USVI and to a lesser extent Puerto Rico. BVI officials claim that over 80 percent of the sport fishing conducted by USVI sport

fishermen, actually takes place in BVI waters.[56] BVI officials complain that USVI sport fishermen even advertise about fishing in the BVI.[57] BVI officials are thus reportedly considering a variety of steps to promote the local sports fishing industry.[58] BVI officials point out that because boats based in Puerto Rico and the USVI have fished in BVI waters, record breaking fish reported for those islands may have actually been taken in BVI waters.[59] One fisherman reports that catch rates for marlins have been steady in recent years.[60]

VII. Catch

BVI fishermen began longlining in 1984. Historical catch data, however, is unavailable. The BVI longline fishermen reported a swordfish catch of about 8 t in 1994.[61] The catch may have declined in 1995 as fewer longliners were reportedly in operation. More current catch data is unavailable.

VIII. Ports

The principal BVI port is Road Town on Tortola. U.S. longliners in the 1980s delivered bycatch to the BVI Fishing Company (BVIFC) at Road Town.[62] (See "Companies".) The BVI longliner active in 1999, *Argus III* delivers its catch to both Tortola and Anegada. The Tortola landings are delivered to the Bitter End Yacht Club at Fat Hog Bay.[63]

IX. Transshipments

The authors know of no swordfish transshipments through the BVI. U.S. longliners licensed by the BVI landed their bycatch in the BVI during the 1980s, but this was marketed locally by the BVIFC.[64]

X. Processing and Products

Some limited swordfish processing has taken place in the BVI, one of the few Caribbean islands where swordfish has been processed. The BVIFC processed the swordfish catch landed by the small longliners in the mid 1990s. The company reported processing fillets, loins, steaks as well as handling whole fish. The most common product form was steaks.[65] The company was not, however, processing swordfish in 1999. Some processing was also done by Sailor's Ketch.[66]

The Neptune's Treasure operation aboard the *Argus III* handles the catch somewhat differently than most other Caribbean swordfish operations. The swordfish is headed and gutted and stored in the ice hold for 4-5 hours until the trunk temperature drops to -1° to +1°C. The trunk is not initially stuffed with ice because the company believes that this would facilitate the growth of bacteria. When the trunk interior has sufficiently cooled, they then stuff the trunk cavity with saltwater ice and pack it in cardboard boxes with more ice. This is unusual as usually the trunks are packed on shore. The company adopted this procedure because they land their catch on two islands. As the fish is already boxed, it can be quickly unloaded.[67]

One problem faced by BVI companies is that a significant part of the inshore catch is affected by ciguatera, a form of human poisoning stemming from the ingestion of subtropical and tropical marine finfish which have accumulated naturally occurring toxins through their diet. Popular species of reef fish are some of the most heavily affected. The toxins are known to originate from several dinoflagellate (algae) species that are common to ciguatera endemic areas--tropical waters, especially coral reef areas like the BVI. Humans affected by ciguatera usually exhibit a combination of gastrointestinal, neurological, and cardiovascular disorders. Symptoms can persist for 6 months after a poisoning incident. While oceanic pelagics, like swordfish, are not usually affected, some inshore pelagics that feed on reeffish can be affected, especially barracuda.

XI. Companies

A. Cooperatives

The DCF encouraged BVI fishermen to form a cooperative in the 1980s. The cooperative, however, was not successful and closed in the late 1980s.[68]

B. Companies

The BVI has two commercial fishing companies. Reports from the BVI vary as to who handles the longline catch. Some reports indicate that the longline fishermen sell their catch themselves directly to hotels and restaurants. Other reports say that two companies process and market swordfish. Presumably practices have varied over time. The BVIFC has also worked with foreign longliners.

The BVIFC: The principal BVI seafood enterprise is the state-owned British Virgin Islands Fishing Company Ltd. (BVIFC). Some reports indicate that the BVIFC processes some of the longline catch.[69] Other reports indicate that it is sold by the fishermen directly to hotels and restaurants. The BVIFC was created in 1980 with FAO assistance to operate the Caribbean Development Bank-financed fish marketing depot which opened in 1983 at Road Town on Tortola.[70] The initial investment in the company was $0.7 million. The company reportedly benefitted the local fishery in several ways. It offered a stable market for the catch; allowed the fishermen to increase fishing time or shorten trips by eliminating the need to eviscerate and clean fish at sea; and regularized the domestic supply to hotels, restaurants, and local domestic outlets. The BVIFC offered ice, gear, and fuel at subsidized prices and assistance in obtaining loans from the BVI Development Bank.[71] One British assessment of the BVIFC was more negative, claiming that the local fishermen do not need the services offered by the company.[72] The company had two cold stores, an ice making machine, and a packing plant.[73] The Tortola depot was designed to regularize the trade and help to avoid occasional oversupply and shortages. BVIFC purchases the daily catch of the island's artisanal trap fishermen. The longline fishermen, however, sell their catch domestically to hotels, restaurants, and individual consumers.[74] The company also operates a carrier vessel which collects fish from the Anegada sub-depot and transports it to the main depot on Tortola. The vessel, the *Fisheries Venture*, was delivered in 1983.[75] The company in the 1980s received the bycatch of U.S. longliners that had been licensed to fish in BVI waters. The unloading was free of charge. The BVIFC did not charge the U.S. longliners for unloading nor did the U.S. fishermen charge the company for the fish. Supplying the bycatch was part of the licensing arrangement. The U.S. longliners landed the fish at the company's facilities on Tortola. The U.S. bycatch consisted of juvenile tuna (under 15 kg), dorado, wahoo, blue marlin, and a variety of other fish. This bycatch was important to BVIFC's operations, providing the raw material for up to 10 percent of the company's sales revenue.[76] The BVIFC's operations were significantly impaired in 1990 when the BVI Government stopped licensing the U.S. longliners and the bycatch was no longer available.[77] The BVIFC in early 1996 was not handling the catch of the small commercial longliners which is marketed privately by the fishermen. BVIFC is, however, considering future marketing arrangements with them.[78] The company currently has very limited operations, handling only about 115 kg of the artisanal catch daily.[79]

Bitter End Yacht Club: The Club is a preferred customer of Neptune's Treasures. The catch of the *Argus III* is often offered to the Club first as they have been a customer of the company for 25 years.[80]

Neptune's Treasures: The company is the largest supplier of marine fish to the BVI market. This family-owned concern in the early 1990s operated two longliners out of Anegada. One was a converted 11-m lobster boat, the other was a 12-m purpose-built fiberglass longliner. The vessels were used for short 3-4 day trip, usually no more than 25-30 km offshore. The catch was sold directly to tourist hotels, other BVI outlets, as well as neighboring islands.[81] The company in 1999 operated the 14.5 m longliner *Argus III*. They operate primarily on the North and South Drop in the Anegada Passage on the Caribbean (leeward) side of Virgin Gorda and other BVI islands. The company makes 4-10 day trips depending on the catch. They set a 50-km line at depths of about 20 meters. It takes nearly 4 hours to set the line and about 8 hours to retrieve it. The line is set at dusk and left to soak overnight. Retrieval begins at daybreak. The catch is primarily tuna, swordfish, marlin, shark, and oilfish. A typical catch includes yellowfin from 18-27 kg, swordfish from 27-45 kg (a few are 70-115 kg), and spearfish 23-27 kilogram.[82] One report indicates that some sets result in very high oilfish bycatches.[83]

Road Town Wholesalers: The facilities of Road Town Wholesalers were badly damaged by Hurricane Luis in 1995 and the company closed.

Sailors' Ketch: This fish processing plant is located at East End on Tortola. This company is owned and operated by the Halpern family. The company obtains the bait and light sticks as well as other imported gear for the Neptune's Treasure fishing operations.[84] Sailors Ketch processes the longline catch of Neptune's Treasure, another family concern. The company

processes the swordfish and other longline catch and markets it domestically rather than exporting it. The swordfish and tunas are sold in the company's own restaurant and hotel, other tourist restaurants, and in the local market. As much of the swordfish and tuna are consumed by foreign tourist paying with foreign currency, these domestic sales are infact actually a form of exporting. The company markets both fresh and frozen product. Much of the fresh sales or unprocessed trunks or processed loins. If the fish can not be sold immediately, it is frozen for future sales. The company also cures oilfish which is a very popular product in the domestic market.[85]

XII. Markets

A. Domestic

Fish marketing in the BVI has generally been conducted by individual fishermen who sold their catch at the landing site or from the back of vehicles driven around the countryside. Handling standards were generally minimal. Most landings and domestic sales are on Tortola. Some of the catch was also sold to middlemen for resale in the USVI. Since 1983 the BVIFC has played an important role in improving the marketing of fish in the BVI. An especially important step was the opening of the BVIFC's marketing depot at Port Purcell in Road Town.[86] The BVIFC divided the catch into type A (finfish, mostly grouper and snappers, hinds, grunts, and snappers) and type B (shellfish, mostly lobster, couto, and conch).[87]

Unlike most other Caribbean islands, there is a strong demand for swordfish on the BVI. This is in part because of the importance of the tourist industry. Demand often exceeds supply. One 1993 report indicated substantial imports are needed to meet the demand.[88] The BVIFC sells swordfish mostly to hotels and resorts, but small quantities are also sold to local consumers through its retail store. The most popular product form is fresh steaks.[89]

B. Trade

1. Exports

BVI fishery exports are relatively limited and primarily directed at the nearby USVI. The authors have little overall BVI export data. Data from the BVI and other British Overseas Territories is not available from FAO which only lists independent countries in its data base. One 1982 report estimated fishery exports at about $0.2 million.[90] The demand of tourist restaurants is not met by local production. Even so, some of the fishermen may export small quantities of seafood if higher prices are available. BVI officials have expressed concern that exports to the United States drives up local fish prices as well as forces locals to buy more expensive imports.[91] Most fishery exports are probably to the United States. Shipments during the 1990s have varied from about 155 t/$0.4 million (1992) to 960 t/$3.8 million (1999). BVI shipments consist primarily of the reef fish species generally taken by the fishermen. The authors note, however, that species not taken in the Caribbean (hake, orange roughy, Patagonian toothfish, and others) are being shipped from the BVI.[92] One of the difficulties faced by BVI seafood exporters are small airports and lack of direct connections with Miami.[93]

The BVI does not export significant quantities of swordfish (appendix C1). this is an indicator of the strong market for swordfish in the BVI. The BVI did export 1 t of swordfish in 1995. The European Union reports that 1 t of fresh swordfish was exported to France (appendix C3).

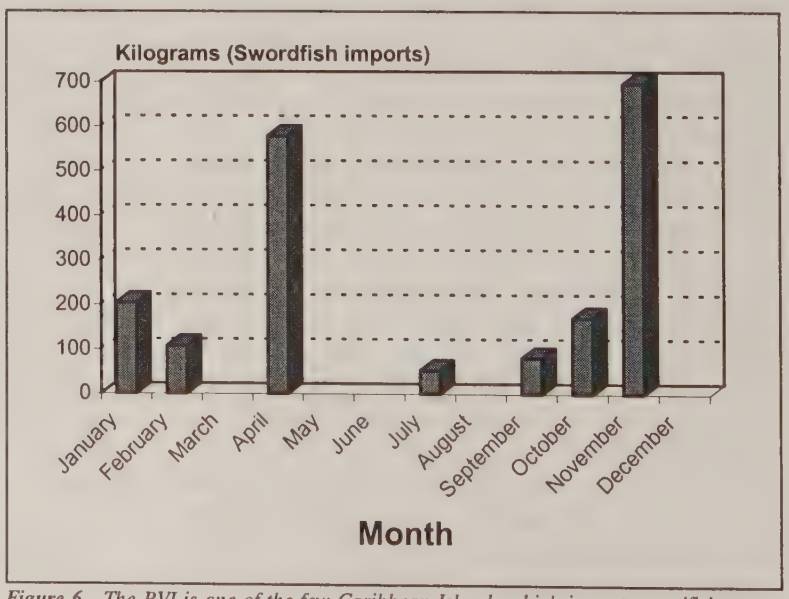

Figure 6.--The BVI is one of the few Caribbean Islands which import swordfish.

2. Imports

There are also modest quantities of seafood imported, mostly to cater to the tourist and expatriate community. No current data are available, but one 1982 report estimated imports at about $0.4 million.[94] The species imported are primarily those taken by the local fishermen (snappers, groupers, lobster, conch, etc.), who can often not supply the needs of hotels and tourist restaurants. Occasional ciguatera outbreaks also make it necessary to import fish.

The authors have no information on the quantities of imported fish involved, but believe them to be limited.[95] One of the major sources of imported product would be the nearby U.S. Virgin Islands. Shipments in the 1990s ranged from 17 t/$77,000 (1992) to 55 t/$230,000 (1998). The products imported have been highly varied. Shipments in 1998 were mostly frozen fish. Substantial quantities of frozen Loligo squid, however, were imported in 1999 and even larger quantities in 2000. Through June 2000, in fact, 47 t of squid were reported (appendix C5b).[96] Such imports are unusual. Squid is not an item normally eaten in large quantities on either the BVI or USVI.[97] While it is possible that the BVI has suddenly acquired a taste for squid, these imports presumably have been imported for bait. The low cost of the squid ($0.81-$1.25/kg) further suggests that it was imported as bait. If so, this suggests expanded longline fishing in 2000. As longline fishermen generally use squid when targeting swordfish, this may mean increased longline activity for swordfish.

One recent report indicated that the demand from the hotels and tourist restaurants is such that some swordfish is imported. One 1993 British study reported annual seafood imports exceeding $0.6 million.[98] A BVI source indicated swordfish imports totaled about 2 t in 1994 which were primarily obtained from suppliers in Puerto Rico.[99] The United States does not track swordfish exports and thus no data is available on such shipments.

Imports appear to be seasonal. Some sources suggest that very little seafood was reportedly imported during the summer months. U.S. imports show some imports during the summer months. Available swordfish import data reflects a seasonal pattern, although only limited data is available. The BVIFC reported minimal swordfish imports during the off season from May through September (appendix C2). This probably is primarily a reflection of the larger demand for tourist season beginning in October. One unconfirmed report in 1996 indicated that a USVI (St. John) longliner (the *Tiburon*) targeting swordfish and tunas was delivering much of his catch to the BVI.

XIII. Government Policy

The BVI agency responsible for fisheries is the Department of Conservation and Fisheries (DCF) in the Ministry of Natural Resources (MNR).

A. Fisheries law

The principal BVI fisheries law is the Fisheries Act of 1936 and the High Seas Fisheries Act. The Fisheries Act along with complimentary Fishery Rules authorize the MNR to manage fishery stocks. The DCF in the MNR establishes minimum sizes and weights and sets seasons as needed. The DCF also licenses fishermen and sets quotas in the 200-mile EFZ.[100] The authors know of no regulations specifically related to swordfish or longline fishing. The DCF is currently planning some major changes to the 1936 Fisheries Act, in part to harmonize BVI regulations with those of the other members of the Organization of Eastern Caribbean States (OECS). The DCF had originally hoped to issue the revised regulations in mid-1996.[101] Preparing the new regulations has proven more difficult than originally anticipated.

B. Limits

The United Kingdom declared a 3-mile Territorial Sea in 1878.[102] U.K. officials established a 12-mile Territorial sea for many overseas dependencies in 1988-90, but the BVI was not included in those declarations. BVI officials are studying the need for a 12-mile Territorial Sea and may ask the United Kingdom to make such an extension.[103] The British declared a 200-mile Exclusive Fishing Zone (EFZ) in 1977.[104] Marine boundary agreements have been negotiated with neighboring jurisdictions.[105] The United Kingdom signed part XI of the Law of the Seas Convention in 1994, but has not yet ratified it.

C. Licensing

1. Commercial/artisanal

The BVI in 1982 established a licensing system for domestic and, initially, foreign fishermen. All fishing vessels harvesting marine products were required to obtain annual licenses. The licenses must specify the fishery to be conducted. The cost of the

license is currently nominal, only US$10 per year. The BVI Government would like to increase the cost. One proposal involves raising the fee to US$150 per boat and $10 per crew member. Once licensed, the owner receives a number which has to be displayed on the boat. The BVI licensing system includes the vessels operating under the terms of the US/BVI Reciprocal Fishing Agreement. (See: "International Relations.") The vessel operators must maintain logbooks and report positions monthly. The bycatch must be landed in good condition for the BVIFC after each trip.

The only gear authorized for foreign commercial fishermen are pelagic longlines. The BVI Government retains the right to require that the vessel operators accept observers onboard each vessel at the owners expense. The authors have noted different quotations on the licensing fees, probably reflecting changes over time. Fees for fishing vessels were initially set at $50 per year and a nominal fee for a fisherman's license (appendix D).[106] Press reports in 1984 indicated much higher fees of about $1,500 per vessel.[107] Another source reported the fee was $7,000 per year.[108] One study of the licensing program suggests that the license fee represented about 4-5 percent of the landed value taken.[109] The fishermen were also required to land their bycatch at no charge in the BVI where it was marketed by the BVIFC. BVI regulations provided for fines of up to $10,000 and up to 1-year imprisonment on summary conviction for fishing without valid licenses. New legislation was reportedly under consideration in 1988.[110] The DCF has licensed foreign fishermen, mostly U.S. longliners operating from the nearby U.S. Virgin Islands. The DCF is in the process of harmonizing its licensing regulations with the OECS and hopes to have new regulations in process by mid-1996.[111]

BVI officials hoped that licensing the foreign longliners would provide training opportunities for the inshore BVI fishermen interested in longlining. Pelagic longlining requires considerable skill and experience. It would be difficult for BVI fishermen to initiate the fishery without such training and experience. The U.S. fishermen did undertake some training. The opportunities, however, were not taken up by many fishermen who were generally unwilling to commit to trips lasting 2-3 weeks. The BVI fishermen were accustomed to short inshore day trips.[112]

The BVI reportedly issued a few longline licenses to foreign fishermen during the late 1980s. BVI officials, however, imposed a moratorium in 1990. They decided that the licensing system for foreign longliners did not sufficiently benefit the BVI. The moratorium was also partly due to complaints from the BVI artisanal fishermen that the foreign longliners were depleting the local resource.[113] BVI authorities have since rejected applications for licenses from foreign fishermen, such as the Taiwan longliners operating from St. Maarten. The only licenses issued since 1992 has been issued for the USVI (St. Johns) based *Tiburon*, which is operated by a USVI resident (appendix D).[114]

2. Recreational

The BVI issues licenses for recreational fishing. Much of the sport fishing activity in the BVI is conducted by vessels from the USVI.[115] Most of the BVI licenses are purchased by charter boat operations out of St. Thomas (USVI).[116] Some Puerto Rican-based boats also fish in BVI waters. One report indicated that the licenses cost $250 per vessel and that 65 were purchased in 1989. Another report indicated that the fee in 1992 was $200 per year.[117]

BVI officials in 1989 were considering a variety of changes in the licensing program to conserve the resource and to help promote the development of the small BVI recreational fishery.[118] Many BVI officials believe the fees should be increased and other changes instituted. One proposal being considered is reducing the number of licenses issued to foreign fishermen. Another proposal involved doubling the fees if the anglers did not land their catch in the BVI.[119] BVI officials report instances in which fish taken by the recreational fishermen have been sold to fishing companies in the BVI for the domestic market.[120]

D. Fisheries development

The BVI Government regards fisheries as one of the islands' principal resources, both to produce food for local and tourist consumption and to generate export revenue. The BVI Government has pursued a number of policies to promote the development of the territory's fishing industry. The Government in the late 1970s, with FAO assistance, created the DCF in the MNR to manage fisheries. The Fisheries Ordinance passed in 1979 gave the DCF the legal authority to manage fishery resources. The Government in 1980 established the BVI Fishing Company to help regularize fisheries marketing. The DCF promoted cooperatives in the 1980s, however, with little success. The DCF has also promoted the introduction of larger vessels and improved fishing gear and methods, securing experts and arranging training courses in cooperation with various foreign donor agencies.[121] (See: "International Relations.") One of

the BVI's principal fishery development activities has been the BVI Fishing Company. (See "Companies".)

XIV. Research

The BVI has collected some data on oceanic pelagics, but actual research is very limited. There are no BVI institutions currently researching large pelagics. The BVI has a small population and the DCF only a relatively small budget. Researching large oceanic pelagics ia a costly undertaking. The small Caribbean islands individually account for only a minor part of the migratory range of these species. Caribbean fisheries are generally small and with a few exceptions do not constitute a significant portion of the overall fishing effort on oceanic pelagics. Except on a few islands, the oceanic pelagic catch is a small part of national landings. Thus it is understandable that the BVI and other neighboring countries have not participated in the research effort. International organizations have provided some assistance with collecting data needed for research and management.

Bitter End Field Station: U.S. universities established a marine research station at Virgin Gorda. The work at the station has focused on marine toxins and drugs, but not fisheries.[122]

CARICOM: The Caribbean Community's (CARICOM) Fisheries Resource Assessment and Management Program (CFRAMP) initiated a biological data collection program for large pelagics in 1995.[123] The CFRAMP effort to collect statistics has, however, proven disappointing because of the lack of cooperation by fishery agencies in member states.[124] CFRAMP in 2000 has been replaced with a new regional project.

Department of Conservation and Fisheries: The DCF in the Ministry of Natural Resources collects some data. The DCF maintains a registry of licensed recreational fishing vessels, although the characteristics are not detailed, nor is catch data collected. The DCF also did not collect data from the foreign longliners licensed during the 1980s.[125]

U.S. Caribbean Fisheries Management Council: The U.S. Caribbean Fisheries Management Council (CFMC) has attempted to work with the BVI to determine the total swordfish effort in the PR/USVI/BVI area. Data collected was to be used to assess the stock size.[126]

U.S. Division of Fish and Wildlife: The U.S. Virgin Islands Division of Fish and Wildlife on St. Thomas in cooperation with ICCAT in 1991 began the shore-based sampling of recreational fisheries.[127]

XV. Bycatch

BVI longline fishermen primarily target swordfish. They also land various ocean pelagics, primarily dorado, tuna, and wahoo (appendix B2). There is also a very small catch of blue marlin.[128] No information is available on the bycatch discarded. Foreign longline fishermen operating under BVI licenses are required to deliver their bycatch to the BVIFC. Most of the bycatch is composed of dorado, escolar, wahoo, tuna, and shark.[129] Bycatch data for the BVI, as for other Caribbean islands, is very limited. Some idea of Caribbean bycatch trends are available by assessing the data reported by the U.S. longline fleet in its Caribbean operations (Caribbean Overview series G appendices and Puerto Rico appendix G1b).[130] The oceanic pelagic catch composition reported by artisanal Puerto Rican fishermen is also of interest (Puerto Rico, appendix D2b2). While this data does not pertain specifically to BVI waters or fishing strategies used by the BVI fishermen, it does provide useful benchmark data. Data from USVI (St. Croix) based longliners may be especially useful (USVI appendices F1a-b). Some bycatch data is available from fishermen on nearby Anguilla, which may also offer some insights into BVI bycatch trends (Anguilla, appendix C).[131]

A. Tuna

The tuna catch reported by BVI fishermen is highly seasonal. It can run 10-50 percent of the longline catch. The tuna catch is the lowest from December to March when the peak swordfish catch is usually taken. The best tuna catches are reported from May to June. Yellowfin usually run 30-40 kilograms. Bigeye range from about 45-55 kilograms.[132] U.S, fishermen operating from the U.S. Virgin Islands report relatively low tuna catches when setting for swordfish about 10-20 percent when setting for swordfish (USVI, appendix F1a-b).[133]

B. Billfish

The billfish taken by the BVI longliners is primarily blue marlin. No other information was available from BVI sources. U.S. longliners operating out of the U.S. Virgin Islands reported similar results. The billfish bycatch on swordfish sets was about 5 percent (USVI, appendices F1a-b). Observer data from 1988-89 show that while mostly blue marlin (over 80 percent) were taken, white marlin and speerfish were also reported, but no sailfish (USVI, appendices F1a-b). Of course the number of billfish and species

distribution were affected by the fishing strategy, relatively deep nighttime sets for swordfish.[134]

C. Sharks

The BVI commercial longline fishermen report that a substantial part of their catch is shark. The overall quantity, however, is limited because the BVI has had only one commercial longliner (*Argus III*) active for any extended period in the 1990s. While a variety of species are taken, generally only makos and threshers are retained because there is no demand for the other species.[135] Details on the species taken by U.S. longliners in the Caribbean have been collected by observers (Caribbean Overview, appendix G4a-b). This published data, however, does not pertain specifically to BVI waters. U.S. longliners operating from the USVI report sharks make up 7-14 percent of the catch (USVI, appendix F1a-b).[136]

D. Other finfish

The lone commercial longline operation in the BVI (Neptune's Treasures) reports large oilfish bycatches. The Sailors Ketch company cures oilfish which is a very popular product in the domestic market.[137]

E. Turtles

Hawksbills, greens, and leatherbacks are found in BVI water and areknown to have nested on the BVI. All three have been harvested by local fishermen and traditionally hawksbills and greens were the most important because they were less seasonal and the products derived were more valuable. The leatherback fishery, however, assumed some cultural importance. Leatherbacks are known as "Trunks" and the fishermen, mostly elderly, who targeted them for oil were thus called "Trunkers". There were once extensive leatherback nesting in the BVI, but one 1990 report failed to note any nesting in 1989.[138]

The BVI began protecting turtles in 1959. Officials were given the authority to set a closed season for both hunting and collecting eggs. Leatherbacks were exempted from the protective provisions, except as pertained to eggs.[139] A separate act established protected areas.[140] The BVI according to a 1990 report had an 8-month closed season on sea turtles. Hunting is only allowed from December to March. The fishermen are primarily interested in the meat. There is an absolute ban on collecting eggs. The Government set the minimum size at which turtles can be harvested at 20 pounds (9.1 kg).[141]

BVI officials are very concerned about local sea turtle populations, especially the critically endangered leatherbacks. Officials and local communities on the BVI are working together on recovery programs.[142] Recreational fishermen commonly spot sea turtles. They report that there are no interactions with the turtles.[143] Some interactions with the longliners has been documented. FD officials confirm that two leatherbacks were incidentally hooked by longlines in 1988. They were cut off from the lines with the hooks still attached.[144] Other information for the Caribbean as a whole, especially the U.S. observer program, offers further insights.[145]

F. Marine mammals

The authors have no information on marine mammal interactions experienced in the BVI. Some information is available on nearby Puerto Rico which may be aplicable.[146] Information is available on the species of marine mammals found off the BVI. Puerto Rican reserachers have conducted an extensive study of marine mammal strandings in waters off Puerto Rico as well as the U.S. and British Virgin Islands, using records going back to 1867. They found reports on 19 different cetaceans. The most commonly stranded species was the bottlenose dolphin (*Tursiops truncatus*). Other species reported in relatively large numbers included: Cuvier's beaked whale (*Ziphius cavirostris*), sperm whale (*Physeter macrocephalus*), Atlantic spotted dolphin (*Stenella frintalis*), and short finned pilot whales (*Globicephala macrorhynchus*). The reserachers reported a increasing incidece of strandings in the 1980s and 90s. When the cause of the stranding could be identified, the ratio of natural to hyman related causes were 1.2 to 1. The most common natural category was dependent calve. The most common human related causes was entaglement and accidental capture followed by animals being shot or speared.[147]

G. Seabirds

The authors have noted no information available on fishery interactions on seabirds. Some information is available on seabirds present on the BVI. Roseate terns are known to nest on the BVI.[148]

XVI. International

A. International relations

1. Multilateral

The BVI has worked with several multilateral organizations involved with fisheries.

CARICOM: The BVI is an associate member of CARICOM. The Caribbean Community (CARICOM)'s principal fisheries activity is CFRAMP.

CDB: The Caribbean Development Bank (CDB) funded some fisheries training for BVI fishermen during the early 1980s.[149] Some of the funds were provided by the U.S. Agency for International Development (US-AID).[150]

CFRAMP: CARICOM's Fisheries Resource Assessment and Management Program (CFRAMP) initiated a biological data collection program for large pelagics in 1995.[151] The overall CFRAMP program is discussed in the Trinidad chapter of this report.[152] One of CFRAMP's core activities was to compile data collected in the region. The program has, however been sharply curtailed in 1998-99. CFRAMP pelagic work has focussed primarily on small pelagics.

FAO: The FAO reportedly provided some technical assistance during the early 1980s.

OECS: The BVI joined the Organization for Eastern Caribbean States (OECS) in 1984 as an associated member. Several OECS projects (the harmonized licensing legislation, joint enforcement and a common fisheries zone) affect the pelagic fishery in the BVI.[153] The BVI has adopted the OECS harmonized fisheries licensing framework and participates in the joint OECS fisheries enforcement program.

ICCAT: The International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for international coordination of research on and management of tuna and tuna-like species in the Atlantic, including swordfish. ICCAT has established catch limits and a variety of other conservation and management measures for many of the species under its purview. As a U.K. Overseas Territory, BVI interests are represented by the United Kingdom which is an ICCAT member.[154] More attention appears to have been given to Bermuda by ICCAT, however, than the British Overseas Territories in the wider-Caribbean.[155] This appears to have been the case even though BVI fishermen have landed more swordfish than Bermuda fishermen during the 1990s. The BVI never applied for or was granted a ICCAT quota in the 1990s, despite the fact that BVI fishermen were landing small quantities of swordfish. Notably, the small quota that ICCAT formerly provided the United Kingdom for Bermuda was changed for 2000 to an overall quota for "U.K. Overseas Territories" which would include the territories in the Wider-Caribbean like the BVI. The authors do not know at this time how the United Kingdom will apportion this quota among its Overseas Territories or the process involved. The annual 2000-2002 quotas for the Overseas Territories are 24 tons. Future U.K. Overseas Territory quotas may be subject to proportional adjustments should ICCAT alter the overall north Atlantic swordfish catch allocations.

UNDP: The BVI Government turned to the United Nations Development Program (UNDP) in 1978 for assistance in promoting the local fishing industry. The UNDP conducted a feasibility study to establish a medium-scale fishing industry and in a 1979 report recommended the construction of shore-based infrastructure. The Government approved a UNDP

Photo 2.--Taiwan longliners operate out of St. Maarten to the south of the BVI. Even more Taiwan longliners operate out of Port of Spain in Trinidad, further to the south. Dennis Weidner

project (BVI/79/001) in 1979 with FAO as the executing agency.[156]

2. Bilateral

The BVI's primary fisheries relationship is with the United States because of the extensive marine boundary.

Canada: The Canadian International Development Agency (CIDA) during the early 1980s provided some training to BVI fishermen to help them expand operations onto the deeper water at the edges of the shelf.[157]

Japan: The Japanese reported no billfish and other swordfish fishing off the BVI in recent years.[158] The Japanese have reported no swordfish catches immediately around the BVI and neighboring islands since 1974 (appendix B3).

Korea: The Korean longline fishery in the Atlantic was substantially scaled back during the 1980s. The Koreans have not reported catches in the area around the BVI since 1986 (appendix B3).

Spain: Spanish fishermen in recent years have moved into the central Atlantic. They have not, however, entered the wider Caribbean area (Caribbean Overview appendix D6). Spanish fishermen have moved into the south Atlantic as well as the Indian and Pacific Oceans, but they have not entered the wider-Caribbean area.[159]

Taiwan: Taiwan, like the Japanese, initiated Caribbean-area longline operations in the 1960s. The primary Taiwan activity has been to the north of the Caribbean, as far as Bermuda, where they have targeted albacore to supply Puerto Rican canneries packing "white meat" tuna.[160] Many of the vessels have operated out of St. Maarten.[161] There is even more Taiwan activity out of Port of Spain to the south. Available evidence suggests that Taiwan longliners are not extensively fishing Caribbean waters, but are using Caribbean ports to transship their catch and maintain their fleet. Taiwan vessels in the mid-1980s began expanding transshipping activities out of Port-of-Spain.[162] The vessels, however, do not appear to be the longliners targeting albacore to the north of the Caribbean. The Taiwan fishermen do not appear to be very active in the Caribbean itself, but have been known to opportunistically set in waters adjacent to the BVI, neighboring Anguilla, and other U.K. overseas territories while in transit between their fishing grounds and Caribbean transshipment points. Taiwan fishermen have not reported catches in these waters since 1987 (appendix B3). In the case of the BVI, the transshipment points would be primarily the transshipment facilities at nearby St. Maarten. Representatives of the Japanese Nichirei Carib Corporation who operate the Taiwan fleet have told British officials that access to BVI and Anguillan waters would be desirable, but not essential for their operations.[163] There have been occasional seizures of Taiwan longliners by the Marine Department (MD) of the Anguillan Police Force on nearby Anguilla.[164] The Nichirei Carib Corporation (NCC) operates Taiwan longliners from nearby St. Maarten.[165] NCC has applied for BVI licenses, but after instituting a moratorium on such licensing, BVI authorities refused the NCC application.[166]

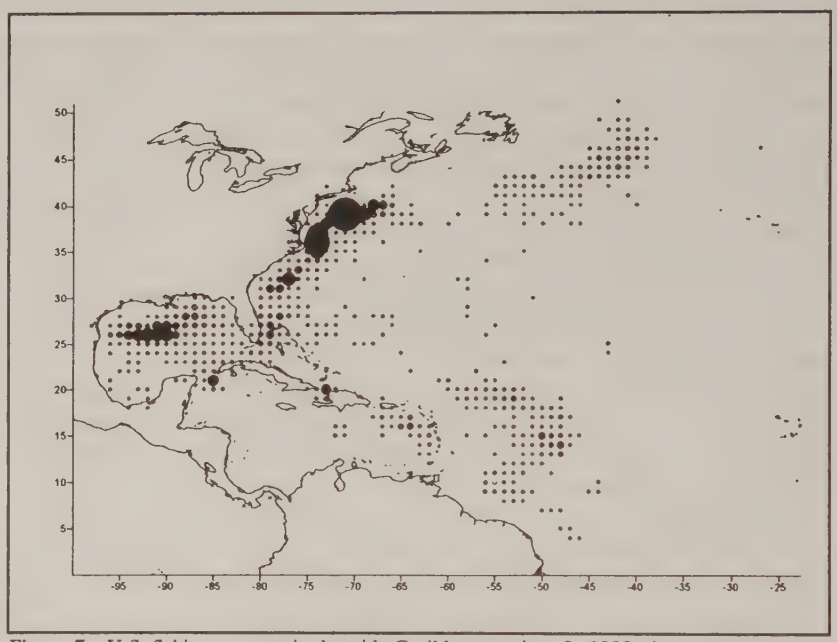

Figure 7.--U.S. fishing patterns in the wide Caribbean varies. In 1995, there were sets south of the BVI, but more effort to the east outside of the Caribbean arc. Cramer

United States: The BVI's primary bilateral fisheries relationship is with the United States. The United States began developing a longline fleet targeting yellowfin tuna in the Gulf of Mexico. Beginning in the mid-1980s, U.S. longline fishermen began targeting swordfish after commercial stocks were encountered off the Florida Atlantic coast.[167] A small number of the swordfish/tuna U.S. longliners are active in the wider-Caribbean, including grounds to the north and east of Puerto Rico and the U.S. Virgin Islands. The U.S. fishery is highly seasonal, primarily conducted during the winter months. U.S. pelagic longline fishermen in the Caribbean often fish in the northeastern Caribbean, but generally to the southeast of Puerto Rico, south of

the BVI (figure 7). There also is some fishing north and northeast of the BVI.[168] BVI officials report that unknown number of U.S. fishermen from the Virgin Islands fish in BVI waters.[169] U.S. and BVI officials have had extensive discussions on fishery issues.

1977: U.K. and U.S. officials met in Washington on May 18-20, 1977, to discuss fishery arrangements between BVI and USVI. The talks were necessary because of the establishment of 200-mile zones by the United States for the USVI and the United Kingdom for the BVI. The two parties developed a draft ad referendum agreement addressing commercial fishing. The U.S. delegation suggested that because U.S. fishermen (from Puerto Rico and USVI) and BVI fishermen have traditionally fished around the BVI and USVI, it appeared practical to attempt to preserve the long-standing cooperative fishery relations between the two islands by developing procedures for assuring continued fishing without disruption. The British agreed to allow existing levels and patterns of commercial fishing to continue, but insisted on defining those levels. The two delegations also agreed to pursue a bilateral fisheries agreement to avoid cumbersome administrative procedures which were not appropriate for the small-scale traditional BVI/USVI fishery.[170]

1979: U.S. and British officials signed the agreement under discussion since 1977 giving artisanal fishermen in the U.S. and British Virgin Islands reciprocal access. No U.S. vessels larger than 55 feet (16.8 m) were permitted. The British agreed to permit six U.S. vessels (between 30-35 feet/9.1-10.7 m) to fish daily in BVI waters at or beyond the 40 fathom (73-m) curve, except during April-June when six vessels were permitted to fish. During the rest of the year only four vessels were permitted. Six smaller vessels (under 30 feet) were permitted to conduct line and trap fishing.[171] The agreement was not ratified by the BVI until 1984. The agreement provided for continued U.S. fishing at traditional levels. Expanded fishing by commercial U.S. flag vessels from the U.S. mainland was not addressed in the 1979 agreement.

1982: BVI officials met with representatives of the U.S. Caribbean Fisheries Management Council in Tortola during 1992 to discuss mutual fishery concerns, such as cooperation on management issues, legal matters, and support of BVI training programs.[172] The USVI Fish and Wildlife Division has assisted BVI officials with some training assistance.[173] One of the proposals discussed was licensing U.S. fishermen to fish in BVI waters and in return the U.S. fishermen would sell their catch at prices of about 50 percent of prevailing international prices.

1983: The BVI/USVI reciprocal fishing agreement for artisanal fishermen signed in 1979 entered into force during 1983.[174] Test fishing conducted off Puerto Rico and the USVI during 1983 showed considerable potential for swordfish longlining.

1984: U.S. swordfish fishermen initiated commercial operations out of Puerto Rico and the USVI in 1984.[175] Several of the fishermen wanted to operate in BVI waters and negotiated an agreement with BVI officials in 1984, permitting the U.S. fishermen to operate 13 longliners in BVI waters. The seasonal licensing fee was set at $7,000 per vessel.[176] The U.S. fishermen were reportedly required to sell their bycatch in the BVI at 50 percent of market value. Other reports indicate that the bycatch was delivered free of charge to the BVIFC. One study indicates that U.S. fishermen beginning in 1984 caught an average of 90 t of swordfish annually through 1990 in BVI waters.[177]

1985: BVI officials reported legal difficulties collecting license fees. Those difficulties were finally resolved and the first licenses were approved for two U.S. Florida-based swordfish/snapper boats.[178] One report indicated 12 licenses were issued in 1985-86.[179]

1986: BVI officials reported in 1986 that many licensed U.S. fishermen were ignoring their obligations to land their catch in the BVI. BVI officials increased the longline licensing fee for foreign fishermen to $15,000 and the number of U.S. fishermen applying for the licenses reportedly declined sharply.

1987: BVI Officials requested a meeting during January, 1987 to discuss the commercial swordfish fishery and informal discussions were held at the GCFI annual meeting. BVI officials reaffirmed that they did not desire to alter the arrangements under the Reciprocal Agreement, although they indicated that they had implemented a moratorium on all foreign commercial trap fishing, including USVI fishing. BVI officials indicated that they did not plan to issue any such licenses until they could assess sustainable yields which would tale at least a year.[180] USVI artisanal fishermen complained about their inability to obtain licenses. One fisherman, Dave Barry, alleged that he was detained by BVI officials and that his first meal in jail was sea turtle.[181]

1989: Informal discussions between NMFS and BVI officials were held in March, 1989 in Road Town. The two delegations discussed enforcement, possible closure of BVI grounds to U.S. fishermen (commercial and recreational), and possible BVI prohibitions of fishery exports to the United States.[182]

Enforcement: BVI officials briefed NMFS on the seizure of the U.S. longliner *Full Moon* and indicated that all U.S. fishing vessels (commercial, artisanal, or recreational) would be seized if found fishing without a valid BVI license.

Possible licensing closure: BVI officials indicated that they were considering the

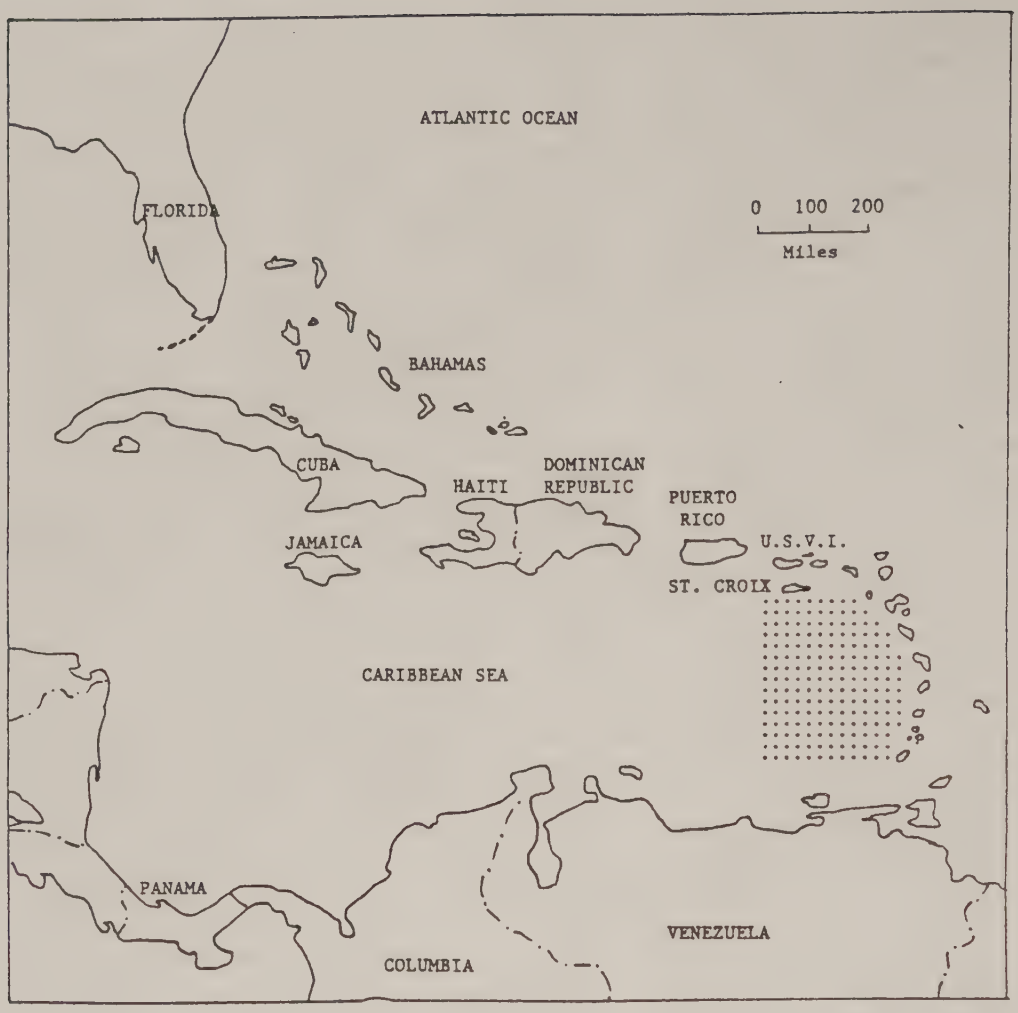

Figure 8--U.S. longline fishermen based in St. Croix often fished south of the BVI and west of the Leeward Islands (shaded area). Edwards.

elimination or restriction of future fishing licenses to U.S. fishermen. BVI officials indicated that all the licenses they issued in 1989 were to charter boat operators, mostly based in St. Thomas, USVI. BVI officials issued 65 licenses in 1989 at a cost of $250 per vessel. BVI officials are increasingly aware of the money generated by the charter boats and would like to promote the sport fishing industry on Tortola and Virgin Gorda. NMFS replied that most sports fishing enthusiasts vacationing in the USVI are unlikely to go to the time and expense of traveling on to the BVI. Excluding U.S. boats would thus not help promote the BVI sports fishing industry, but would only result in the loss of licensing revenue.

Threatened export ban: BVI officials are considering a ban on fishery exports to the USVI which they believe are driving up local prices, both from lower domestic supply and the need to import more seafood. In fact, there were no BVI fishery shipments to the United States in 1990. There were shipments of $3.8 million in 1999 (appendix C4). Some of that product, however, does not appear to be fish actually taken by BVI fishermen.

1990s: Some U.S. swordfish longliners were reportedly landing fish in the BVI during the early 1990s, but the authors believe this was mostly the bycatch species which is required by BVI regulations. Most licensed U.S.-flag fishing has reportedly ceased since 1991.[183] This appears to be primarily because the DCF stopped issuing licenses. Since 1992 the BVI has issued a license to only one longliner, the USVI (St. Johns)-based *Tiburon*. BVI officials required him to sell his entire catch in the BVI at BVI-set prices.[184]

1991: U.S. officials approached U.K. officials (on behalf of the BVI) to consider possible discussions on access to BVI waters. These feelers, however, have not been followed up on. USVI fishermen believe that the BVI authorities are not living up to the terms of the 1979 Reciprocal Fisheries Agreement (RFA). BVI authorities stress that the RFA stipulated that access was conditional on maintaining existing fishing patterns and levels. A subsequent minute clarified this, specifying that fishing patterns referred to deep line fishing and to trap and line fishing. BVI officials insist that this does not include commercial longlining. BVI officials do not believe the RFA is in their best interests because the two countries do not benefit mutually. There are many more USVI fishermen who want to fish in the BVI than BVI fishermen who want

to fish in the USVI.

1993: A British consultant suggested that if future discussions are held with the United States, "Every effort should be made in future discussions or negotiations to ensure more equal treatment. It is to be hoped that the wide acceptance that payment of fees is an integral part of current licensing makes appeals to past agreements and precedents redundant."[185]

B. Joint ventures

The authors know of no joint ventures involving swordfish.

XVII. Enforcement

The BVI, like the other U.K. overseas territories, has the legal right to control foreign fishing in their EEZs. This includes longline fisheries for oceanic pelagics in offshore waters. In practical terms, however, the BVI finds monitoring foreign fishing activities difficult if not impossible--especially in the outer limits of their EEZs.

Several agencies are involved in enforcement. The primary agency responsible for fisheries enforcement in the BVI is the Royal Police Force (RPF) located at Road Town on Tortola. Two other agencies, however, are also involved. The National Parks Trust has a marine unit which monitors reef and other areas frequented by tourists. The Conservation and Fisheries Department is responsible for licensing fishing boats and tourist boats visiting the National Parks Trust area where moorings have been established.[186]

BVI officials believe that there is significant unauthorized fishing in their waters, but have been frustrated because they did not have the enforcement capability to patrol their zone. Officials have expanded BVI's enforcement capability in recent years. The British Government provided a fast Halmatic patrol boat in 1989 and a Piper Navajo airplane in 1992. The United States in 1996 provided funds for patrol craft to BVI officials as part of the drug interdiction effort.[187] The RPF acquired a 8-m patrol boat for fisheries in 1997. The BVI Government has to fund operating costs, although some limited funds for dedicated fishery patrols were obtained from OECS. The RPF patrols are primarily aimed and interdicting drugs and illegal immigrants. Fishery patrols are a secondary priority.[188]

Several fishing vessels based in the USVI have been boarded and cautioned about BVI licensing requirements. The RPF obtained another patrol boat in 1988 any may request additional assistance in fisheries enforcement from the Royal Navy. One of their primary concerns appears to be swordfish longline operations, primarily conducted by U.S. fishermen based in the USVI, Puerto Rico, and Miami.[189] Taiwan operations are also of some concern. Enforcement officials are convinced that their enhanced patrol capability, despite the limited priority given to fisheries, is having some affect and that foreign longliners are now setting further offshore.[190]

A British study reports that there is reason to believe that illegal foreign fishing occurs from time to time.[191] Limited information is available on BVI enforcement actions.

1984: BVI officials arrested five U.S. fishermen in 1984 for fishing in BVI waters without a license. One of the vessels involved was the *Pit Bull Gang*. The U.S. fishermen insisted that they were permitted to fish under the terms of the 1979 Reciprocal Agreement.[192] The trial was held in June 1984, but details on the outcome are unavailable.

1987: BVI officials seized the U.S. fishing vessels *Sueño* and *Wandelyn* during early December 1987. The vessels were based in Puerto Rico. Six fishermen aboard the vessels were arrested. The fishermen claimed they were fishing in U.S. waters off Santa Cruz, but had to put into Road Town on Tortola because of mechanical problems aboard the *Wandelyn*. BVI officials accused them of fishing in BVI waters.[193]

1989: BVI officials seized the U.S. longliner *Full Moon* on February 23, 1989 which had set its longline gear on Baracuda Bank in waters north of St. Thomas, USVI, but in BVI waters. BVI fishermen on Anegada had been complaining of U.S. longline activity in the area. BVI officials fined the captain and each of the crew members $10,000 each and the catch was confiscated. The total cost of the seizure was about $100,000 when the cost of defense lawyers and the value of the catch was calculated.[194]

1990: The BVI imposed a moratorium on licenses for U.S. longline fishermen operating from the nearby USVI (St. Croix). BVI officials believe, however, that a significant number of U.S. longliners were operating in BVI waters without licenses. BVI officials speculate that up to 40 U.S. longliners may have been operating in BVI waters. BVI officials thought most of them were operating from the USVI, especially St.

Croix.[195] The authors can not confirm the number of vessels operating in BVI waters. It is likely, however, that several of the vessels may have been from the larger number of U.S. longliners operating from San Juan.[196]

1990s: The BVI has reportedly seized several USVI boats, but no details are available.[197] BVI officials also express concern about large number of recreational boats from the USVI and Puerto Rico which are used for fishing in BVI waters.[198] The BVI's "North Drop" area is especially popular with sport fishermen targeting blue marlin.

1995: Hurricane Marilyn struck St. Croix (USVI) in September 1995, devastating the island. Some longliners were sunk. The U.S. longline activity from the island was, as a result, terminated. Because of the immense damage to the islands's infrastructure, longline operations were no longer feasible.[199] In addition to the damage to vessels and facilities, the sharply reduced tourist trade ment that few flights were available to ship the catch to U.S. markets. Presumably this drastically reduced the alleged illegal operations of the U.S. longliners operating from St. Croix in BVI waters. Some U.S. fishing activity from the larger number of San Juan based longliners, however, probably continues.

1999: BVI officials continue to express concern about the large number of recreational vessels which are used for sport fishing it its waters. Fishermen particularly complain about the substantial number of large recreational vessels based in San Juan which they derisively refer to as the "Puerto Rican Navy".

XVIII. Future Trends

Various assessments of the BVI fishery suggest that the islands could support a small fishery for oceanic pelagics. Fishing effort of foreign fishermen substantiate that swordfish and other oceanic pelagics are present in BVI waters and in adjacent Atlantic Ocean waters to the north and east of their EEZ. Several BVI fishermen in the mid-1990s attempted to initiate pelagic longline operations, but most experienced difficulties. One fisherman reports small catches and continues to operate his longliner. The catch is marketed domestically. BVI fishermen after the disappointing results in the mid-1990s have shown little interest in entering the longline fishing levels. the authors know of no new longline project. Bait imports, however, suggest some increased fishing activity during 1999 and 2000, but the authors have no details on expanded BVI operations.

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52. Randolph M. Walters, "The sport fishery in the British Virgin Islands," *GCFI Proceedings*, November, 1982, pp. 184-187 and Lowell Wheatley, Captain of *Basic Lady*, personal communications, January 11, 2000.
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60. Wheatley, *op. cit.*, January 11, 2000.

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63. M. Soares, *op. cit.*, May 18, 1999.

Section IX. (Transshipments)

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Section X. (Processing and Products)

65. Fergus, *op. cit.*, January 17, 1996.
66. Lee, *op. cit.*, May 13, 1999.
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Section XI. (Companies)

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69. Fergus, *op. cit.*, January 17, 1996.
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72. R.W. Beales, *Report of Fisheries Management Options in Caribbean Dependant Territories* (Overseas Development Administration: London, 1988).
73. Robert Lee, Anguillian Offshore Fisheries Development Project, personal communications, May 13, 1999.
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77. MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 99.
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79. Lee, *op. cit.*, May 13, 1999.
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81. MRAG, "Large pelagic fisheries ...," *op. cit.*. p. 93.
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84. M. Soares, *op. cit.*, May 18, 1999.
85. Lee, *op. cit.*, May 13, 1999.

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91. Christian, *op. cit.*, March 10, 1989.
92. U.S. Customs Service.
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94. FAO, "Assistance to fisheries ...," *op. cit.*, p. 1.
95. Walters, "Status ...," *op. cit.*, p. 29.
96. U.S. Customs Bureau.

97. Meyers, *op. cit.*, June 30, 2000.
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102. Territorial Waters Jurisdiction Act
103. U.S. Embassy, London, "British Virgin Islands considers extending Territorial Sea," message number 22161, November 20, 1992.
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116. Mike Christian, NMFS, personal communications, July 28, 1987.
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118. Since U.S. billfish regulations are reducing the billfish take, it would appear that the desire to promote the BVI sports fishery may be more important than the conservation concerns. Christian, *op. cit.*, March 10, 1989.
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120. MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 91.
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123. CARICOM/CFRAMP, "Statement by the CARICOM (Caribbean Community) Fisheries Resource Assessment and Management Program (CFRAMP)," ICCAT Doc. No. 018, November 13, 1995.
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129. Vanterpool, *op. cit.*, January 31, 1996.
130. U.S. Caribbean bycatch data is summarized in the Puerto Rican chapter of this report.
131. See the Anguillian chapter of this report for details,
132. Soares, *op. cit*, May 18, 1999.
133. This data comes from the U.S. longliners operating out of Ct. Croix in the USVI and is based on observations during two trips in 1988-89. W. Tobias, "Billfish bycatch observer data of the U.S. longline fleet, St. Crooix, U.S. Virgin Islands--1988 and 1989," *Collective Volume of Scientific Papers* (SCRS/90/83) (ICCAT: Madrid, 1991), pp. 518-522. Much more comprensive observer data is now available, but published results are for the Caribbean area

as a whole and do not separate out the Puerto Rico and St. Croix based vessls. Since 1995, almost all of the U.S. effort is conducted from San Juan in Puerto Rico.
134. Tobias, "Billfish bycatch ..., " *op. cit.*, pp. 518-522.
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139. BVI Government. Turtle Ordinance, (CAP 87), May 21, 1959, 775-776.
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141. U.S. Embassy, Antigua, "Sea turtle conservation in UK dependencies," message number 929, June 15, 1990.
142. Michael A. Downs, "Anegada sea turtle recovery project," internet posting accessed January 12, 2000: http://www.irf.org/turtle.htm
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148. D.A. Shealer and J.G. Zurovchak, "Three extremely large clutches of roseate tern eggs in the Caribbean," *Colonial Waterbirds*, vol. 18, no. 1, 1995, pp. 105-197.

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150. FAO, "Assistance to fisheries ...," *op. cit.*, p. 34.
151. CARICOM/CFRAMP, "Statement by the CARICOM (Caribbean Community) Fisheries Resource Assessment and Management Program (CFRAMP)," *op. cit.*
152. The CFRAMP Pelagic/Reef Fishing Unit was initially run from St. Vincent. The program has since been curtailed and the remaining staff person moved to Trinidad in 1999.
153. For details on the OECS efforts, see the Caribbean Overview of this report.
154. Individual European Union members are no longer ICCAT members. It was agreed at the 1997 annual ICCAT meeting that all EC Member States would withdraw from the Commission effective December 31, 1997. The sole exceptions were France and the United Kingdom which then rejoined in respect of their overseas territories.
155. For details see the Bermuda chapter of this report.
156. FAO, "Assistance to fisheries ...," *op. cit.*, p. 2.
157. Walters, "Status ...," *op. cit.*, p. 28.
158. See for example: Y. Uozumi, "Preliminary analysis on the distribution of sailfish and longbill spearfish in the Atlantic Ocean in 1993 based on logbook data, ...," *ICCAT Collective Volume of Scientific Papers* Vol. 54 No. 3 (SCRS/95/156) (ICCAT: Madrid, Spain, 1995), p. 285-287 and ICCAT, "1994 SWO background document: Figures," *ICCAT Collective Volume of Scientific Papers* (ICCAT: Madrid, Spain, 1995), p. 91.
159. ICCAT, "1994 SWO background document: Figures," *op. cit.*, p. 91; J. Mehuto, P. Sánchez, and J.M. de la Serna, "Nominal catch per unit of effort by length groups and areas of the longline Spanish fleet targeting swordfish (*Xiphias gladius*) in the Atlantic, years 1988 to 1990 combined," *ICCAT Collective Volume of Scientific Papers* SCRS/91/49 Vol. 39, No. 2 (ICCAT: Madrid, 1992), pp. 615-625; and J. Mejuto, B. Garcia, and J.M. de la Serna, "Activity of the Spanish surface longline fleet catching swordfish *Xiphias gladius*) in the year 1998," *ICCAT Collective Volume of Scientific Papers* SCRS/99/75, in press.
160. See the Bermuda chapter of this report for more details.
161. For details on St. Maarten see the Netherlands Antilles chapter of this report.
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163. British officials spoke with Mr. Hashitani at the Nichirei Carib Corporation. MRAG, "Large pelagic fisheries ..., *op. cit.*, p. 6.
164. For details see "Enforcement" in the Anguilla chapter of this report.
165. For details see the St. Maarten chapter of this report.

166. MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 91.
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168. Jean Cramer and Heather Adams, "Large pelagic logbook newsletter - 1996," *NOAA Technical Memorandum* (NMFS-SEFSC-407), January 1998, p. 3 and Jean Cramer, "Large pelagic logbook newsletter - 1995," *NOAA Technical Memorandum* NMFS-SEFSC-394, November, 1996, p. 3.
169. Walters, "Status ...," *op. cit.*, p. 27.
170. Carmen J. Blondin, memorandum on negotiations for fisheries access arrangements for U.S. vessels of the U.S. Virgin Islands and Puerto Rico and vessels of the British Virgin Islands, June 7, 1977.
171. The small vessels were limited to a specified area. British Virgin Islands/U.S. Virgin Islands Reciprocal Traditional Fisheries Agreement, London, March 27, 1979.
172. U.S. Caribbean Fisheries Management Council, Memo, October, 1982.
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174. U.S. treaties: 34 UST 3147, TIAS 10545.
175. For details see the Puerto Rican chapter of this book.
176. Moore, *Coastal State Requirements for Foreign Fishing,* op. cit., p. 170.
177. MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 98.
178. Mike Christian, NMFS, personal communications, February 13, 1985.
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182. Christian, *op. cit.*, March 10, 1989.
183. Fergus, *op. cit.*, January 17, 1996.
184. Jason Dalmida, comments at Virgin Islands tuna/billfish meeting, June 7, 1995.
185. MRAG, "Large pelagic fisheries ...," *op. cit.*, p. 92.

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192. Regina Boyd, "V.I. fishermen to face charges in Tortola," *The Daily News*, May 21, 1984 and Regina Boyd, "Fishermen's trial produces 'heat,' grumbling," *The Daily News*, June 7, 1984.
193. "Detienen a seis pescadores en la isla de Tórtola," *Diario las Americas*, December 16, 1987.
194. Christian, *op. cit.*, March 22, 1995.
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197. Rebecca Lent, NMFS, personal communications, June 7, 1995.
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Appendices

Series A: Fleet
Series B: Catch Data
Series C: Transshipments
Series D: Foreign Fishing and Licenses
Series E: Market
Series F: Exports
Series G: Sports Tournaments
Series H: Seabirds

Appendix A.--British Virgin Islands. Longline fleet, 1996

Vessel	Size	Owner	Status
	Meters		
BVI vessels			
Argus III	14.6	Vernon Soarse	Active in 1996-99
Lady Drew	18.0	NA	Rigged for longlining in 1996, inactive in 1999
Ms Wendy S	19.8	Stevens family	Being prepared for operations in 1996
Pices II	12.1	NA	Inactive
SeargentFish	15.2	NA	Inactive
Unknown	20.1	NA	Converted shrimp trawler, inactive in 1999
Unknown*	13.7	NA	Converted shrimp trawler, inactive in 1999
Foreign vessels**			
Tiburon***	NA	Jason Dalmida	Undergoing repairs in early 1996

NA - Not available
* Two other small longliners were inactive as of early 1996
** Licensed by the BVI in 1996
*** U.S. longliner based in St. Johns, USVI.
Source: Various

Appendix B1.--British Virgin Islands.
Fisheries catch, 1980-97

Year	Catch
	Metric tons
1980	318R
1981	318R
1982	318R
1983	318R
1984	318R
1985	318R
1986	318R
1987	1,248
1988	1,248
1989	1,357
1990	1,377
1991	1,400
1992	1,000F
1993	757
1994	900F
1995	1,000F
1996	1,000F
1997	950F

F - FAO estimate
R - Repetition of data submitted by BVI officials in previous years.
Source: FAO, *Yearbook of Fishery Statistics*, (FAO: Rome, various years).

Appendix B2.--British Virgin Islands, Longline catch, 1994

Month	Species				Total
	Swordfish	Dorado	Tuna	Wahoo	
			Pounds		
January	212	249	392	247	1,100
February	3,802	230	659	1,298	5,989
March	403	102	368	-	873
April	924	152	669	61	1,806
May	226	205	142	-	573
June	914	390	-	167	1,471
July	-	-	-	-	-
August	582	-	-	-	582
September	653	337	102	-	1,092
October	2,640	92	302	216	3,250
November	3,282	161	195	-	3,638
December	4,893	203	354	220	5,670
Total	18,531	2,121	3,183	2,209	26,044

Source: Joyce Fergus, Assistant Manager, BVI Fishing Company, personal communications, January 17, 1996.

Appendix B3.--Northeastern Caribbean. Foreign swordfish catches in the northeastern Caribbean, ICCAT area 1560

Country	Year	Quarter				Total
		1	2	3	4	
			Metric tons			
Japan	1961		0.1			0.1
	1962		0.9	0.2		1.1
	1963		0.8	0.3		1.1
	1964		2.3	0.1		2.4
	1965		0.8	0.2		1.0
	1966	0.4	8.6	3.7	1.2	13.9
	1967		0.2			0.2
	1968	0.3	0.4	0.8	0.1	1.6
	1970		0.1	0.1		0.2
	1971	1.3	0.2	2.2		3.7
	1974				2.7	2.7
Korea	1977		0.7		1.1	1.8
	1978		0.4	5.6	2.1	8.1
	1979	0.2	0.8	1.3	2.8	5.1
	1981			0.1	0.2	0.3
	1985		0.2	6.2	0.2	6.6
	1986	0.1	0.3			0.4
Taiwan	1968			3.1		3.1
	1969		0.1		0.5	0.6
	1970		0.4	0.1	1.5	2.0
	1971		1.1			1.1
	1972		0.2			0.2
	1974		0.9			0.9
	1975	2.7	1.2	0.2		4.1
	1977		0.3	0.6		0.9
	1978		0.1	Negl		0.1
	1979		0.7		0.1	0.8
	1980		2.6	0.1		2.7
	1981		0.8	0.1		0.9
	1982		4.0	0.4		4.4
	1983		1.0			1.0
	1984		0.1	0.1	0.5	0.7
	1985		0.4	0.1		0.5
	1986		0.2	0.1		0.3
	1987		0.5	0.2		0.7

Source: ICCAT

Appendix C1.--British Virgin Islands. Swordfish exports by destination, 1991-95

Destination	Year									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Metric tons									
United States	-	-	-	-	-	-	-	-	-	-*
Japan	-	-	-	-	-	-	-	-	-	-
European Union	NA	-	-	-	-	1	-	-	-	-
Others**	NA	NA	NA	NA	NA	NA	-	-	-	-
Total	NA	-	-	-	-	1	-	-	-	-

* Through February
** Swordfish shipments to other countries are believed to be non-existent or negligible
Source: Various

Appendix C2.--British Virgin Islands. Swordfish exports, 1994

Month	Imports
	Kilograms
January	205
February	108
March	-
April	579
May	-
June	-
July	54
August	-
September	82
October	172
November	696
December	-
Total	1,896

Source: Joyce Fergus, Assistant Manager, BVI Fishing Company, personal communications, January 17, 1996.

Appendix C3.--European Union. Swordfish imports from British Virgin Islands, 1991-95

Country	Commodity	Year								
		1991	1992	1993	1994	1995	1996	1997	1998	1999
		Metric tons								
France	Fresh	-	-	-	-	1	-	-	-	-
Total		-	-	-	-	1	-	-	-	-

Source: EU. Eurostat data.

Appendix C4.--United States. Fishery imports from the British Virgin Islands, 1990-2000

Year	Quantity	Value
	Metric tons	US$1,000
1990	-	-
1991	212.3	809.0
1992	156.6	398.5
1993	385.5	635.9
1994	279.0	731.0
1995	265.8	915.8
1996	297.7	1,041.4
1997	627.5	2,247.8
1998	425.4	1,578.2
1999	959.9	3,776.8
2000*	396.8	1,558.3

* Through June
Source: U.S. Customs Service

Appendix C5a.--United States. Seafood exports to the British Virgin Islands, 1998-2000

Month		Year		
		1998	1999	2000
		Metric tons		
January		4.3	-	2.0
February		0.1	2.1	-
March		6.9	1.6	8.3
April		2.7	0.3	47.2*
May		2.5	1.1	5.3
June		-	-	2.0
July		1.0	2.2	
August		0.5	25.3*	
September		-	-	
October		5.2	-	
November		-	-	
December		32.1	0.6	
Total	Squid	-	23.6	47.2
	Other	55.3	9.6	17.6
	Total	55.3	33.2	64.8

* Large squid shipment, see appendix C5b.
Source: U.S. Customs Service

Appendix C5b.--United States. Squid exports to the British Virgin Islands, 1998-2000

Year	Quantity	Value
	Metric tons	US$1,000
1998	-	-
1999	23.6	29.5
2000	47.2*	38.5*

* Through June
Source: U.S. Customs Service

Appendix D.--British Virgin Islands. Longline licenses, 1984-96

Country	Licenses	Fee
	Number	US$
1984*	13	150
1985	12	150
1986	12	15,000
1987	NA**	15,000
1988	NA	15,000
1989	NA	15,000
1990	NA	15,000
1991	NA	15,000
1992	1***	15,000
1993	1	15,000
1994	1	15,000
1995	1	15,000
1996	1	15,000

Note: 1984-86 data based on unconfirmed reports.
* Agreement negotiated with U.S. swordfish longline fishermen.
** Unconfirmed reports suggest that the number of license applications declined after the BVI increased the fees in 1986.
*** Since 1992 the only licenses has been issued for the USVI-based *Tiburon*.
Source: Various.

Appendix H.--British Virgin Islands. Seabird nesting, 1984

Area	Information	Species*	Known** threats	Importance***
BVI	Reasonable	3?, 5-7, 10-14, 16, 18-20, 22	Ex, Ha, Pr?, Po?	Important

* Species: 3 - Puffinus I. lherminieri; 5 - Phaethon aethereus; 6 - P. lepturus; 7 - Fregata magnificens; 10 - S. leucogaster; 11 - Pelecanus occidentalis; 12 - Larus atricilla; 13 - Sterna maxima, 14 - S. sandvicensis acuflavida; 16 - S. dougallii; 18 -S. anaethetus; 19 - S. fuscata; 20 - S. (albifrons) antillarum; 22 - A. stolidus
** Threats: Ex - exploitation of eggs, young or adulkts; Pr - predators, generally introduced mammals; Ha - habitat distruction or disturbances; Po - pollution; Fi - fisheries
*** A rough subjective rating of relative importance of area for breeding seabirds.
Source: Ruud van Halewyn and Robert L. Norton, "The status and conservation of seabirds in the Caribbean," in J.P. Croxall, P.G.H. Evans, and R.W. Schreiber (eds.), "Status and conservation of the world's seabirds," *ICBP Technical Publication*, No. 2 (ICBP: Cambridge, 1984), p. 175.